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ABSTRACT

This overview study examines the systems presently used at Purdue University to circulate library and audiovisual materials in the general library, the 28 departmental libraries, and the audiovisual center. Also examined are three basic approaches to the automation of library circulation systems, with examples drawn from systems already in operation. In addition, the impact of the emergence of consortia of libraries dedicated to cooperative processing of materials has been considered and incorporated into the design. The conclusion of the design team is that the on-line system at Ohio State University be adopted with minor modifications for use at Purdue. Of particular interest in a technical sense are the recommendations for use of a new technology, light pens reading bar-encoded labels, and the adaptation of an existing operational circulation system from another university. The proposed system will also have an impact on other future university applications because of the inclusion of the bar-encoded, machine readable label on the university passport usable for many purposes. (Author)

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Overview Study

for the

Purdue University

Libraries and Audio-Visual Center

Circulation System

November 15, 1973

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SUMMARY AND CONCLUSIONS

This Overview Study examines the systems presently used to circulate library and audio-visual materials in the General Library, twenty-eight departmental libraries, and the Audio-Visual Center. Also examined are three basic approaches to the automation of library circulation systems, with examples drawn from systems already in operation. In addition, the impact of the emergence of consortia of libraries dedicated to cooperative processing of materials has been considered and incorporated into the design. The conclusion of the design team is that the on-line system at Ohio State University be adopted with minor modification for use at Purdue. Of particular interest in a technical sense are the recommendations for use of a new technology, light pens reading bar-encoded labels, and the adaptation of an existing operational circulation system from another university. The proposed system will also have an impact on other future University applications because of the inclusion of a bar-encoded, machine readable label on the University passport useable for many purposes.

The proposed system is operationally feasible, will enhance traditional circulation functions, will better utilize existing resources, and will provide greatly increased capabilities for the Purdue Libraries and Audio-Visual Center System.

Attached to this report are two copies of ADPC form number 120 which contain scheduled dates for the start and completion of the various project tasks and activities. In order to meet these schedules, approval of this report is needed by February 1, 1974. If approval is not obtained by then, the two schedules may have to be revised before work can begin.

INTRODUCTION

This study focuses on the development of a library circulation system and is a logical follow-on to the General Plan which was approved on April 15, 1973. The General Plan specified a list of library automation project objectives, not all of which apply to the circulation application. Therefore a list of specific circulation system objectives has been developed as a prelude to the general design of a circulation system.

OBJECTIVES

The library circulation system project objectives are as follows:

1. Reduce or at least slow the pace of increase of personnel costs required to provide adequate circulation services.

2. Release circulation system personnel time to allow them to provide improved patron services.

3. Provide additional patron services not otherwise feasible because of technical and/or cost considerations.

4. Provide faster patron service, thus increasing user satisfaction with the library's circulation system.

5. Improve the availability, quality, accuracy, breadth of coverage, and currency of circulation system statistical information for management.

6. Improve the accuracy and timeliness of circulation system operational data.

7. Provide more efficient interfaces between the circulation system and other University systems.

8. Provide circulation system interfaces to systems external to the University.

9. Establish a data base which will serve as a basis for systems development in the foreseeable future.

10. Insure compatability of the circulation system functions and data base with the Cooperative Bibliographic Center for Indiana Libraries (COBICIL) and developing Indiana, national, and international standards.

11. Utilize existing system designs and computer programs wherever possible.

12. Utilize data collection devices whenever possible to reduce clerical activity.

13. Improve the security of library materials and data files thereby reducing the incidence of library materials being removed without proper checkout, and insure that library records cannot be irretrievably destroyed.

The afore listed objectives are inclusive. They reflect the needs of the Purdue Libraries and Audio-Visual Center, especially the general needs of improved services and improved utilization of resources to achieve increased cost effectiveness. Please read the objectives very carefully. These are fundamental guidelines to be adhered to by the development team in creating the detailed design of the circulation system.

Please note that these objectives are not necessarily biased toward the computerization of circulation functions. Rather, automating should be viewed as developing the best blend of computerized and manual processing systems and the best blend of output media, such as printouts, terminal displays, micro-forms, etc., to achieve the stated objectives.

COST EFFECTIVENESS

Underlying the statement of each of the above thirteen objectives is the general objective of improving the cost effectiveness of the Purdue Libraries and Audio-Visual Center. Cost effectiveness is not solely a matter of reducing costs but rather one of relating the benefits obtained from investing in new services and facilities to the funds expended.

The expenditure of funds can be accounted for in a straightforward manner. Personnel, materials, and computer facilities needed for the development and operation of a system can be costed out by multiplying accumulated quantities by standard rates.

Benefits are not so easily quantified. Certainly there can be

expectations of savings in supplies which can be costed out using invoice prices, but the saving of staff time is another matter. The sources of such savings are the computerization of manual functions and the increased accuracy of operating data. Typically, such savings are hard to sum together to enable an FTE position to be eliminated. Rather, the time savings are scattered among several positions and the extra time available may be spent doing new tasks or absorbing an increased transaction volume. An additional complication is that time savings can occur in units outside of the library. For example, automation of the interface to process encumbrances might directly benefit the Bursar's Office.

An even more difficult benefit to evaluate is the savings in library user time. Savings should result from faster circulation operations and services and more accurate data being available. Even if this quantity is measurable in a particular situation, the library administrator has no control over how the freed-up time is to be spent.

Any analysis of costs and benefits must take into account the avoidance of future cost increases. As the library is a labor intensive operation, the impact of inflation on salaries and wages is an important factor to consider. Any reduction in FTE positions, of course, eliminates the effect of inflation on that portion of the wage and salary budget. In addition, to the extent that there is an increase in the number of transactions which can be handled without additional FTE positions, inflationary wage trends can again be negated. Rising wage rates are then traded for more stable computer rates, computer costs tending to remain constant because of continuing increases in machine efficiency due to improved technology.

It is expected that benefits will derive from increased security of both library materials and data files. There is no suggestion that the materials security problem can be attacked directly by the automation project, however, the institution of systems which reduce the users dissatisfaction with the library can be expected to improve the situation. For example, there should be a reduction in the incidence of unauthorized borrowing as indicated by a count of items missing from the shelves but for which no circulation record exists. Also, improved systems may allow library personnel to schedule specific time for security duties.

File security is an expensive function, both in terms of reconstructing a lost file for which no backup exists and of providing backup copies. The periodic microfilming of manual files is expensive. These costs can be largely avoided by using machine readable files which can be electronically copied. Thus, the benefit of avoiding security expenses must be counted in any analysis.

Management information is still another benefit which is difficult

to measure. It is expected that better decisions can be made regarding the amount and subsequent allocation of book funds, purchase of duplicate copies of materials, institution of appropriate loan and binding policies, space and facilities planning, assignment of personnel, and evaluation of alternative methods of book selection. This will result in better utilization of the resources of the Libraries/AVC. Again, the avoidance of costs, in particular clerical time needed to accumulate the required data, can be quantified and used as justification.

The improvement of services has been touched on before through the discussion of saving user time. Supplying more accurate, more timely, and more varied sources of information through improved access to the circulation records and shelf list surely must benefit the patron and the University. We see no way in which to assign a dollar value to these improved services. Certainly, a favorable response can be expected from the users. At Ohio State University, the response to a new circulation and searching system contributed to a significant increase in the utilization of the OSU Libraries as measured by the amount of borrowing.

The final factor to consider is one for which quantitative data are available but over which the Libraries/AVC has little control. Overhead costs, primarily fixed facilities and general University overhead, are difficult to assign to someone else. Any work space saved in the libraries can well be used for other library purposes since additional space is badly needed. The most advantageous way to view overhead is not to worry about its reduction but rather its improved utilization. Should we be able to raise a variety of transaction rates, particularly the number of circulations per year, the unit costs of the transactions will drop as the overhead factors and personnel costs are held down.

In summary, we face the old problem of being able to identify cost savings but not being able to accumulate them in a way which enables us to reduce the Libraries/AVC budget. This situation may not be palatable but certainly is preferable to ignoring so-called intangible benefits.

OUTLINE OF REPORT

The following section contains a description of the current situation in the Purdue Libraries and Audio-Visual Center and the multitude of circulation systems now in use. Three systems are used as models to represent the entire variety now in operation. The deficiencies and problems with the present situation are also

presented.

This is followed by a description of automated circulation systems already operational and of the types of data collection technology used by these systems.

The next section describes the circulation system which is proposed to serve the entire campus. The description is in functional terms and includes material on alternative designs and technologies considered, the influence of emerging cooperative groups and national and international standards of information exchange, and the need to interface and be compatible with other University systems.

The concluding section summarizes the cost and benefits of the proposed system and presents a schedule for implementation.

Appreciation is expressed to the five members of the Circulation System Advisory Group who greatly aided development of this proposal by contributing ideas, gathering data, and reviewing working documents generated by the Library Systems Unit.

DESCRIPTION OF EXISTING PURDUE SYSTEMS

Documenting the current circulation systems in use in the Purdue Libraries/AVC has turned out to be a very complicated project. The circulating of books in and out of a library and maintaining records necessary to keep track of the transactions (the activity traditionally considered as circulation) seems at first glance to be a fairly straightforward activity. If there were one library circulating one type of material with one circulation policy, this would make matters relatively simple, but this is not the case at Purdue.

The Purdue Libraries and Audio-Visual Center System is made up of 28 school and departmental libraries, the General Library, and the Audio-Visual Center. Each one of these locations establishes its own circulation policies and rules, its own files, and its own procedures for handling circulation activity. In other words, each location operates its circulation activity independently of other locations. A survey of the 30 locations revealed similarities, but not a single case of two or more locations using the same policies, procedures, etc. in the circulation activity.

The one common feature of all 28 departmental libraries and the General Library is the card catalog (or shelf list) record. Since all cataloging is done centrally, each of the 29 library locations has the same book cataloged in the same way. This catalog record is held both centrally in the General Library and in each departmental library where the item is held. There are, however, materials in all of the locations which have been recorded only locally. Records of these local items are not held centrally.

Home use (outside the library) circulations have generally increased over the years, e.g. from 1964/65 to 1971/72 the total increased from 310,689 to 444,164. But in 1972/73 the total dropped somewhat to 422,523. These totals include all departmental libraries and the General Library.

Even though the general trend throughout the libraries has been one of increasing circulation, the General Library has shown a decreasing trend while the departmental libraries have shown large increases from year to year. Only the 1972/73 year showed any decrease from the previous year for the departmental libraries.

The Audio-Visual Center also showed a decrease from 1971/72 to 1972/73. Appendix A summarizes the circulation statistics from 1964

to 1973 for both home and library uses.

Information documenting the current systems was gathered in a number of different ways. The following were the techniques and sources of that information. (Much of the work done in the Overview Study is documented in a series of Library Systems Unit working papers. These are listed in Appendix D.)

1. The Circulation System Advisory Group - This group was made up of five librarians, one closely asscciated with the General library circulation activity, three from the departmental libraries, and one from the Catalog Unit. Their job was to advise Library Systems Unit personnel in the work being done for the Overview Study.

2. 'The Circulation Overview Study, Existing Campus System Survey' (COS 6/73) - This was a 13 item survey sent to each library location, asking for detailed information about each. The survey was explained and collected by members of the Advisory Group. The surveys were completed by persons most closely involved with the circulation activities at each location, not only the professional librarians supervising.

3. 'The Circulation Overview Study Survey' (COS 19/73) - This was a 10 item survey sent tc each library location requesting more details not determined in the first survey. In addition, this survey was the main instrument for gathering cost data from the various locations.

4. Interviews in 1971 by Library Systems Unit personnel with librarians throughout the Libraries/AVC System to determine needs and problems with existing situations.

5. A detailed study by Mr. James Leet, an IBM Assistant Marketing Representative, in August 1972 of the circulation system used in the General Library.

6. Informal interviews with librarians and other personnel involved with the circulation activity.

Although there is much variation among the 29 locations, there are basically two circulation systems in use at Purdue. (The Audio-Visual Center circulation activity is, however, unique enough to consider as a third one.)

TRANSACTION CARD SYSTEM

The first basic system (called a 'transaction card' system) is in use at the General Library and the Krannert departmental library. These two locations accounted for approximately 206,000 home use charges in 1972/73 (or about 49% of the total circulation activity at Purdue, not including the Audio-Visual Center). This system is used in the General Library and Krannert Library for all materials leaving the libraries except reserve and reference items. In the transaction card system there is no pre-recorded information which remains with the book. Every time a book is circulated, a new bibliographic and identification record has to be created. The following is a general description of the operating procedures. A detailed flow chart is included as Appendix B.

1. When charging out a book, the library user fills out a three part home use form for each item. The user is required to fill out his/her name, address, and status and the author's name and short title of the book. A Purdue passport may also be used for stamping on the home use form.

   The library clerk takes the home use form and a separate, pre-numbered transaction card, and writes the call number of the book so that it appears on all parts of the home use form and transaction card. The transaction number is written so that it appears on the home use form and the book pocket.

   The pre-numbered transaction card is placed in the book pocket and stamped with the due date. The home use form is separated into one transaction slip and two overdue slips. These are filed the next morning in a transaction number file (divided by date due) and in a call number file (divided by floor in the General Library).

2. To discharge an item, the pre-numbered transaction card is removed from the book and compared against the work room transaction file. The matching card is then pulled to compare against the call number file. The matching card is then pulled from the call number file. At various points in this discharge procedure, the following questions must be answered and appropriate action taken:
   A. If book has been renewed, a renewal file must be checked and a record purged.
   B. If the book is to be held for someone else, that person must be notified of the book's availability and the reshelving of the book prevented.
   C. Does the call number agree throughout the procedure with the transaction number associated with the

transaction? Several checks are made throughout for accuracy.

3. To renew an item, the transaction number is needed to trace through and update the files. (A call number can be used but this is generally discouraged.) A book is renewed if a save has not been placed on it and if certain other restrictions do not apply. The transaction number file and the call number file are updated in this procedure.

4. When a book becomes overdue, all files must be updated. Overdues are automatically identified by the transaction file since it is divided by the date due. The first overdue notice is already prepared since one of the slips from the home use form is used, but notices, letters, and encumbrances after the first overdue notice are prepared individually and with considerable clerical effort.

5. A save is placed on a book by appropriately flagging the transaction file and typing a notice for the shelvers to prevent the book from being reshelved when it is returned.

6. Books are recalled from borrowers for two main reasons, either another borrower is waiting to use the book, or the book is to be placed in a class reserve collection for short term loans.

   If another borrower wants a book that is already checked out, he/she fills out a save card requesting the book. The library clerk flags the transaction file card so that an availability notice can be sent when the item is returned. At the same time a notice is typed for the shelvers so that the book itself can be caught when returned. If a book is overdue, then the recall notice and the overdue notice are essentially the same thing.

   Policies concerning when a book may be recalled and how the borrower is to be notified vary, depending on the situation. A typed notice or a telephone call may be used to perform the actual recall, depending on the urgency of the situation. In any case, the transaction card is always tagged or marked in some way concerning the action taken in recalling an item.

7. Status inquiries and problem inquiries have no formal procedures. (Problems or 'snags' resulting from a missing transaction card in either the circulation file or returned book are handled as outlined in the flow chart in Appendix B.) The card catalog, any of the numerous circulation files, or any of the listings or files associated with the circulation activities might be searched when resolving these problem inquiries.

8. Statistics concerning the number of users leaving the library are tallied by an an exit control clerk (who at the same time checks the legality of books leaving the library).

Statistics on class reserve and home use circulation are tallied once per day by a circulation clerk. In library use statistics are kept by the shelvers. Both of these statistics are tallied once each day and totaled monthly.

Files Used in the Transaction Card System

1. Workroom bin - file of materials currently checked out to patrons - in transaction number order by due date

2. Files located at the loan desk:
   - A. File of books checked out in sequence by call number
   - B. File of books located in the attic or warehouse
   - C. Books on indefinite loan
   - D. Books checked out to departmental libraries for their class reserve collection
   - E. Books classified as 'temporary missings'
   - F. Books classified as 'permanent missings'
   - G. Books on loan to the Reserve Book Room (RBR)
   - H. Books in the Prevention of Loss (PL) collection
   - I. Books in binding
   - J. Faculty loans arranged by type of loan and number of notices sent

3. Reserves - call number file of materials requested by library patrons

4. Class Reserves - books on loan to departmental libraries for their class reserve collections

5. Encumbrance file - a file of all students, faculty, and staff with books which are long overdue

6. 'Says returned' file - all 'says returneds' which have fallen overdue

7. Visitors' permits - includes people with visitor's permits, graduate two month permits, and faculty assistant permits

8. Clear-let file - includes all encumbrances which have been cleared within the last two years

9. Be-let file - includes a listing in both call number and transaction number order of materials over one year overdue. (All other circulation records of these books have been destroyed except for the encumbrance file.)

10. Lists of lost books which have been paid for and re-ordered

11. Mailing file - of all books mailed out in U.S. mail

12. People count - list of the number of people leaving the library per day - temporarily separated into the periods of 0800-1700 and 1700-2400 hours

13. Ledger - call number listing of books paid for

14. Black book - list of missing transaction cards, blue or gray copies

15. File of books checked out during the current day
    A. Transaction number order - grouped into three week, two month, and overnight loans.
    B. Call number order - arranged by floor

16. Where file - books reported missing from one to six months

17. Transaction card file - (unused transaction cards stored temporarily awaiting use - in transaction number sequence)

Forms Used in the Transaction Card System

Well over 100 separate forms exist for this system. The most significant ones are:

1. Three part charge out form

2. Transaction card (pre-numbered and notched)

3. Availability notifications (several types exist)

4. Overdue notices (several types exist)

5. Status notification (if non-circulating)

6. Requests to the Bursar to encumber student records

7. Visitor and special status permits

8. Page requests (for books in the warehouse or attic)

9. Reserve (save) forms

10. Search requests

11. Renewal slips (two part)

12. Special location cards

13. Lost and found

14. Clearance forms for encumbered records

15. Several loose leaf notebooks where lists of overdues, encumbrances, etc. are kept.

Summary

In general, the transaction card system is a complicated system of multiple files which are constantly manipulated with considerable clerical effort. This holds true in both the General Library and the Krannert Library even though use of the transaction card system varies between the two libraries. Delinquent users are not identified in any reliable way. The save procedure is cumbersome and not very reliable. A new record must be created each time a charge is made, creating considerable margin for error. Much of the duplication of files and identification numbers exists as an attempt to protect the borrower from errors while expediting the reshelving of library materials. The two main advantages to the transaction card system using the three part home use form are the handling of overdue notices with a fair degree of efficiency and the quick return of items to the shelf. Overdue notices are a very big part of the circulation activity in all systems at Purdue since there is neither a fines system nor any other effective means of getting materials returned to the library. The encumbrance of grades and records is used only as a last resort and are generally only effective at semester's end.

BOOK CARD SYSTEM

The second basic system in use at Purdue is the book card system. All libraries at Purdue except the General Library and the Krannert Library use variations of this system and account for approximately 51% of the total circulation activity. This system is also the one generally used for all class reserve collection circulation in both the departmental libraries and the General Library.

As opposed to the transaction card system, this system has for each item to be circulated a pre-recorded book card which stays with the item except when it is actually in circulation. This relieves the borrower from transcribing call number and bibliographic information about the item each time the it is charged out. The book card contains enough space for several charges before a new card needs to be prepared. The following is a general description of the procedures involved in the book card system. A detailed flow chart is included as Appendix C.

1. When charging out an item, the library user removes the book card from the book and fills out his/her name and address (or has it stamped using the University passport). The library clerk hand stamps the due date on both the book card and date due slip in the book.

   The book cards are collected during the day and normally filed into main circulation file (usually arranged by call number) the next morning, although the exact procedure varies among the libraries.

2. To discharge an item, the call number is checked in the book and compared with the main circulation file to find that call number. When found, the book card is pulled from the file, the due date is crossed off to indicate return of the book, and the card is inserted into the book pocket. The book is then ready for reshelving unless the book card is flagged in some way to show that the book is to be held for another borrower. In this case the book is held in a certain area and a notice prepared to notify the next borrower of its availability.

3. To renew an item the call number is required so that the book card can be found in the main circulation file. When found it is stamped with the new due date and collected with the current day's charges for filing the next morning. If a flag on the card shows it is to be held for another borrower, or some other restriction applies, then the renewal is blocked.

4. Overdue books are identified by looking through the entire main circulation file, card by card, checking the date due. If the book is overdue, a notice is prepared and mailed, noting the date it is sent on the book card in the file. Overdue notices must be individually prepared for each overdue item. This entails the transcription of bibliographic information and call number data from the book card to the overdue notice. Each notice must also be addressed individually, many times using out of date addresses from the passport. In this system, the main circulation file should be checked in its entirety each day, but in reality, most libraries fall behind in this effort and only check part of the file each day. Additional notices are sent at various times, depending on the policy of the particular library. Overdue class reserve books are handled in much the same way in both the General Library and the departmentals, but notices are usually sent more promptly and are more individually tailored.

   In all cases special letters are typed for long-overdue items along with encumbrance notices to the Bursar when appropriate. Overdue procedures are the most time consuming part of the book card system.

5. A book is saved (held for another borrower) by flagging the book card in the main circulation file in an appropriate manner (depending on how the particular library handles it, e.g., a colored plastic paper clip). When the book is returned, the flag notifies the clerk that a save has been placed on the book. The person for whom the book is being held is identified by a handwritten note on the book card.

6. Books are recalled from a borrower for several reasons, but the two main reasons are for charging out to another borrower or for placement in a class reserve collection. There are no set procedures for recalling a book, and policies on when a book may be recalled vary from one library to another. It usually depends on the situation, i.e., if needed immediately such as for placement in a class reserve collection a notice is relayed by phone, and if not urgent, a notice is typed and sent by mail. When a book is recalled for any reason, a note or tag of some type is placed on the book card in the circulation file noting the action taken.

7. Status inquiries and problem inquiries (snags) have no set procedures. The card catalog, any of the circulation files, or any listing or file supporting the circulation activities might be searched when handling these inquiries.

8. Statistics on persons entering or leaving the library are usually kept by the circulation clerk. Statistics on class reserve and home use circulation are tallied once each day (by classification number) by the circulation clerk. These statistics are usually totaled on a monthly basis.

Files Used in the Book Card System

The types of files in the book card system are highly varied. These files contain circulation and special location/status information about cataloged monographs and serials, uncataloged serials (unbound issues), theses, technical reports, class reserves, A-V materials, and a wide variety of miscallaneous materials. These various files are arranged in a number of ways including call number, Cutter number, author, title, identification number, subject, publisher or issuing agency and due date. The survey of existing circulation systems on the Purdue campus revealed that at least 87 files kept in the departmental libraries to keep track of circulation activities. In addition, at least 48 other supporting files are maintained for circulation activities.

The main circulation file of all cataloged materials charged out is, however, the one file common to most of the book card systems. It is arranged by call number in most cases, with serials often arranged in a separate section by title.

All of the files used in connection with the circulation activity are card files, except for a few instances where loose-leaf notebooks are used for special listings.

Forms used in the Book Card System

1. Book card (remains with the book when it is not charged out, and filed in the circulation file when the book is charged out.) When the card is full of users' names, a new one is typed, filling in the call number and bibliographic information.

2. Various forms for charging out uncataloged materials and those with no book card. All identification and bibliographic information must be filled out with these forms as the item is being checked out. Some are printed, others are mimeographed

or dittoed.

3. Class reserve charge out forms for short term loans.

4. Overdue notices for different classes of users, i.e., students, faculty, etc.

The book card system is a simple, fairly straightforward system of keeping track of circulation activity. It also requires considerable clerical work in preparing all the overdue notices, writing recall and hold notices, and filing book cards into the main circulation file. Many functions require the removal (and subsequent refiling) of cards from the various files.

As with the transaction card system, delinquent users are not identifiable in any reliable way. Both systems use a blacklist, usually posted next to the circulation file, which must be checked each time a person charges out materials.

The save procedure works fairly well since the book is in hand at the time the notice to hold the book is discovered. The margin for error is reduced in the book card system since the call number and bibliographic data are pre-recorded for each item.

The major work involved in using the book card system results from its lack of any automatic batch-like procedures. Even though procedures are usually handled in groups, everything that is performed on a particular transaction, requires individual time consuming clerical effort. When the transaction volume grows to any large proportions, the clerical effort required to maintain currency is very great.

THE AUDIO-VISUAL CENTER CIRCULATION ACTIVITIES

The Audio-Visual Center can be considered as another departmental library within the Libraries/AVC system, but it does have several unique features. First of all the materials handled in the Audio-Visual Center are obviously of a different format than printed materials (although many audio-visual materials have printed materials included with them), and the entire AVC operation is basically a closed stacks operation. In other words, borrowers do not have self-service access to the collection as is true in all other campus libraries, except for the class reserve collections.

The Audio-Visual Center handles about 61,000 (1971/72) in-library over-the-counter loans and about 12,000 home or out of library loans

per year. The 61,000 figure took an unexpected drop down to 42,000 from 1971/72 to 1972/73, which is similar to the situation in the rest of the Libraries/AVC system. All types of audio-visual materials and equipment may be borrowed from the Audio-Visual Center. Catalog records of all these materials are not recorded centrally in the General Library but are recorded and cataloged in only the Audio-Visual Center. Records are held in both card and book catalog format. Most of the films, filmstrips, slide sets, and media kits are now recorded in machine-readable format and are readily available for automatic processing.

There are basically two types of circulation activities performed by the Audio-Visual Center. The first system compares very closely to operations in a class reserve collection. Although there are many general interest audio tapes in the collection, it is made up almost entirely of audio tapes (open reel and cassette) created for use by specific classes on campus, e.g., modern language classes utilize the collection heavily. The record of this collection is a card catalog containing an assigned classification for each item. A few pieces of equipment and other miscellaneous audio-visual materials are available in this collection, but they make up a very small part of the total use.

Although items from this collection are used on a short term (2 hours) library-use-only basis much like a class reserve collection, it differs from most class reserve collections on this campus in that each item does not have a pre-recorded card already created for it. In this respect it is much like the transaction card system, i.e., each time an item is charged out a new card has to be filled out by the borrower. To charge out an item, the user fills out his/her name and address or uses a Purdue passport and fills in the call number and title of the item. The clerk retrieves the item requested and issues it to the borrower. The circulation card is stamped by a time clock and is filed by listening station. The item is discharged by stamping the return time on the card, reshelving the item, and appropriately retaining the card in subject order for statistical purposes. The card is later discarded. The length of a loan is typically for at least an hour, but it could be as short as two or three minutes. There are no large files connected with the circulation activity for this type of transaction.

The second circulation system used in the Audio-Visual Center is that used for booking and scheduling materials, equipment, rooms, and people to be used at some future date. Nothing like this is done in the other libraries, except possibly in the area of saves, but even then no scheduling is done. Although any of the audio-visual materials including equipment can be used in the Audio-Visual Center on a first come, first serve basis, most of the audio-visual materials are booked and scheduled in advance. Both immediate and future loans of audio-visual materials and equipment are handled in basically the

same way. A partial list of the types of audio-visual materials handled contains:

16 mm films
8 mm films
Filmstrips
Slide sets
Media kits
Video tapes
Records
Audio tapes
A-V equipment
Projection Service

Any of these items may be booked by phone, letter, or in person. A detailed form must be completed which in turn results in several other forms and notices being typed and filed. Many files are involved in this operation and much time is spent filing and updating records, resulting in a considerable number of errors. This entire circulation system is a typical scheduling problem requiring much record manipulation.

Files Used in the Booking-Scheduling System

1. Booking card files (alphabetical by title)
2. Future shipping file (by ship date)
3. Completed order file (by shipping point location)
4. Completed ship file (by shipping point location)
5. Due back file (by due date)
6. Daily scheduling log (by date)
7. Work order file (by use date)

Forms Used to Collect Transaction Data

1. Check out card for short term in house loans
2. Equipment loan form for in house use
3. Booking form for outside use and in house scheduling.

SPECIAL CONSIDERATIONS IN THE DESIGN OF CIRCULATION SYSTEMS

There are a number of basic functions needed in every circulation system that must always be considered and implemented, but the survey of the current systems in use at Purdue and interviews with the librarians and clerks involved with circulation activities revealed a great number of special considerations and problems to be dealt with in the design of any proposed new system. Most of these considerations are problems common to all the circulation systems now in use at Purdue, but not all apply in every case, nor do they exist as problems to the same degree in every location. The following is a discussion of the important considerations:

1. How is the user to be identified in a reliable way? Current systems at Purdue accept a university passport (used in a stamping machine) or will accept other ID's requiring the transaction to be handwritten. The passport cannot be trusted to have the correct address and may not provide any address at all after June 30, 1974. The handwritten transaction is often illegible and the deciphering of it quite time consuming. Persons not affiliated with the University are permitted to use the Libraries but are required to have special identification such as a visitor's pass.

2. There are over 30 types of uncataloged materials identified as being items which are circulated from the Libraries/AVC. These types of materials are usually handled on a very individualized basis in the current systems. Almost all of them have to have a complete bibliographic record created each time an item is circulated. Many of these have no other record of their existence. To further complicate their circulation, the unique identification of the item to be circulated is not always self evident.

3. Circulation policies such as length of loans, status of borrower permitted to use materials, where materials may be used, number of renewals permitted, number of overdue notices sent and at what intervals, when a user's records are encumbered for non-return of

materials, restrictions on library use because of past offenses (delinquent borrower), length of time a book will be held for another borrower, for what reasons a book will be recalled, when an item is declared lost and its record removed, overnight loan privileges, and class reserves and other restricted materials, etc. have every possible combination and permutation possible.

4. The status of a specific item (not in its proper shelf location) at any one point in time requires consultation of many files other than the main circulation file. Sixteen different types of files or locations were reported as possible hints in determining the status of an item, but up to date status information is often non-existent. Approximately 450 such inquiries were reported as being received each day (This does not include the A-V Center, since it is basically a closed stack operation).

5. A survey revealed that most of the campus libraries will not accept phoned or written requests for materials from individuals. Most will, however, accept such requests from other campus libraries, which will in turn loan the item to an individual.

Almost all of the campus libraries reported that all off-campus loans to other libraries are handled by the Interlibrary Loan (ILL) Service based in the General Library. The campus library loans the item to ILL then ILL loans it off-campus.

6. Writing overdue notices is a very big part of the circulation activity. In those libraries using the book card system, over 1200 per week are prepared. The two transaction card systems reported over 1300 overdues sent per week.

7. The gathering of statistics concerning circulation activity is a very time consuming activity. All data is now gathered and manipulated manually. It is generally agreed that circulation statistics are probably the best indicator of library use patterns now available. These statistics serve as basic data for the management information needed by the administrators and supervisors. This activity must be an integral part of any circulation system.

A complete survey of the statistics gathering activity in the Purdue Libraries/AVC is contained in a study by the Instructional Media Research Unit, (IMRU), entitled, "Study of Purdue Library Statistics", July, 1972. Further study is currently being carried out to determine the Libraries/AVC needs in this area.

8. In a one-person departmental library, the circulation activity is almost a full time job for that person, not leaving time for other service oriented activities. Most of the circulation time is spent in filing and notice preparation.

9. The actual charge out transaction is very time consuming, especially in the transaction card system.

10. The processing of end of semester overdues and encumbrances needed to ensure the return of materials is cumbersome and usually not fast enough to catch the borrower before he/she leaves the campus. One needs to be able to determine all items charged out to the user.

11. Delinquent users are not identifiable, allowing them to commit further abuses.

12. Information on storage and special status items is usually not current enough to be reliable. It is not uncommon for such data to be six months out of date.

13. Time constraints for current systems.

A. Circulation records and special location/status data should be available as soon as possible. Present systems have data on circulation activity available within 24 hours. Special location/status data updates take much longer, the time often being measured in months. Lack of current status information causes much frustration in the present systems. Absolutely current data is needed for many AVC activities and the class reserve collections.

B. Overdue notices are sent out usually no more than two days after the item is due, but this activity falls behind quite often. Two days until a notice is sent should be the maximum.

C. Recalling borrowed items is done daily, but in most cases depends on mail delivery.

D. Renewals are current within 24 hours.

E. Save (personal reserve) records are generally current within 24 hours, but should be more up to date.

F. End of semester needs are for immediate notification of proper authority to encumber records. Delinquent patrons are currently unidentifiable. Absolute currency is needed at semester's end to ensure clearing of records before students and faculty leave the campus.

14. The number of saves on a particular item has been known to total 14.

DESCRIPTION OF EXISTING AUTOMATED SYSTEMS

This section of the report describes in functional terms a variety of existing automated circulation systems which were studied in detail during the course of development work. Several distinct systems philosophies and technologies are presented to give the reader an overview of the current state of the art in the field.

A considerable amount of time and effort has been expended in developing this material. The starting point was a thorough survey of library science literature describing both operational and theoretical systems, technologies now being used or in the development stage, and principles for the design of automated circulation systems. See Appendix E for a list of the principal literature sources used. In addition to the literature search, visits were made to ten different sites to view the operation of existing systems and/or discuss with librarians and data processing personnel the development and operation of circulation systems. See Appendix F for a list of the schools and firms visited. Where time did not permit, schools and firms were contacted by telephone to learn more about their operations. These schools and firms are also listed in Appendix F. Documentation was obtained whenever available. The results of this phase of project development have been to acquaint the library systems design team with the latest developments, to obtain documentation for detailed study, and to establish contacts at other schools and firms to aid circulation system development work at Purdue.

All systems investigated handle to some degree the basic circulation functions found in the current manual systems at Purdue. These systems vary in the extra services offered, the technology used for data collection, and the configuration of the data processing facilities utilized.

BATCH SYSTEMS

Batch systems handle the basic circulation functions of checkout, checkin, overdues, fines, saves, recalls, renewals, status inquiry, and statistics gathering with a minimum of clerical intervention. Data is gathered through the use of a data collection terminal in conjunction with machine-readable patron identification and an identifier (punched card or book label) accompanying each book. In

cases where a transaction is handled over the telephone, a save or renewal is placed, or when there is a missing patron or book identifier, the basic identifying data must be keyed by a clerk.

Daily transaction (checkouts, checkins, saves, and renewals) data are accumulated on magnetic tape by the terminal controller and processed by the central computer each night. The circulation system files are updated and fresh printouts provided to each library by the next morning. Status inquiry is accomplished manually through the use of these printouts. Statistics gathering is a by-product of the computerized file updating process. On a less frequent basis, overdue notices, fine notices, recall notices, and management reports are printed by the central computer.

Two magnetic tape files are needed to implement a batch system: a circulation file to record those items checked out and a patron file to provide addresses for the printing of notices. The latter file requires a method for maintaining the data contained in it.

The advantages of a batch system lie mainly in the reduced clerical and patron effort needed to operate it, and the minimal added investment required. Use of a data collection terminal automates the basic data gathering task involved with checkout, checkin and statistics gathering. Overdue notices, recall notices, and fine notices (including calculation of amounts) are generated by the computer with a minimum of clerical intervention as the needed bibliographic and patron data is already contained in the computer files and the applicable policies vested in the logic of the computer programs. Generally a multiplicity of manual files and the accompanying procedures to manipulate them are eliminated by a batch circulation system. In cases where the equipment is not available and transactions must be recorded manually for a brief period of time, there is no loss of circulation information to the patron as the transactions are not processed until that night anyway.

A batch system does not require as much added hardware or as complex software to operate as other types of automated circulation systems. No communication facilities, added core memory or added disk storage capacity are needed. The principal investments are for terminals, controllers to record the terminal transactions, and batch computer programs to process the data.

The disadvantages of a batch system are that the typically short turnaround times required for some types of items (two hour loans for example) cannot be reflected in the printouts rapidly enough to provide the needed status and overdue information, and for those items assigned normal loan periods, status information is out of date by one day, causing confusion among patrons and possibly the generation of false recall, fine, overdue, and save transactions. In addition, the status data is provided through printouts which are expensive to

produce and a burden to print and distribute. Also, at checkin, items having saves on them must still be identified manually. Finally, instant error checking of transactions is not available. Although the magnetic tape controller can make format checks on the transactions, such errors as the double checkout of an item where a master record must be accessed to verify the transaction cannot be caught until long after the fact.

Batch systems function well within the limitations described above. Systems were viewed in operation at the University of Wisconsin at Milwaukee and at Temple University, and plans for another at Indiana State University were discussed. The Temple system offers the added feature of on-line file inquiry as an adjunct to the daily status printout, although of course the computer file is a day out of date.

HYBRID SYSTEMS

Through the use of more sophisticated hardware and software the typical hybrid system offers service improvements over a batch system. As with a batch system the traditional circulation functions of checkout, checkin, overdues, fines, saves, recalls, renewals, status inquiry, and statistics gathering are handled with a minimum of clerical intervention. Data collection terminals are utilized to record data for computer processing.

The various transactions are recorded and processed very much like those in a batch system. The important difference is in the type of terminal controller used. In a batch system the controller records transaction data after completing a very simple format check on the incoming data. In a hybrid system the controller is a small computer which can be programmed to do extensive edit checking of transaction data and provide data storage facilities for several small on-line files. Typically two files are kept on-line: a list of items having saves on them and a list of delinquent patrons. The first file is utilized to automatically signal the checkin clerk that an item should not be shelved, while the second file is used to signal the terminal operator that the transaction is being blocked because of the patron's status. Facilities are needed of course to maintain the data on these two files. As with a batch system, files are maintained on the central computer to record items checked out and to hold patron address data.

The advantages of a hybrid system include all of those listed for a batch system although the investment required is larger due to the increased capabilities of the terminal controller. Services and clerical efficiency are increased through the availability of the

delinquent patron and save files.

The disadvantages of a hybrid system are those found with a batch system. An important exception is that given enough storage capability, the small computer controlling the terminals can also be utilized to control reserve book room operations in an on-line mode. To date there is no evidence of a library implementing such a reserve book system.

Hybrid systems have been installed at the University of Pennsylvania, American and Georgetown Universities, and the University of Maryland. No clear cut cost-benefit advantages over a batch system are seen for any of the hybrid systems.

ON-LINE SYSTEMS

The final type of system to be examined is the on-line system. It handles the basic circulation functions on an almost instantaneous basis. Data collected at terminals is immediately transmitted to the central computer site and processed against the master files. Transactions are completed by transmitting information back to the originating terminal, indicating error conditions or proper completion of the transaction. Additional major functions are handled; specifically instantaneous status inquiry and a form of bibliographic searching of the updated master files. Batch processing is used to produce statistical reports, overdue notices, fine notices, and recall notices on a scheduled basis.

Five different files, at a minimum, are needed to implement an on-line system. A circulation file will contain records on items checked out, including data on saves. A patron file is needed for printing notices and to provide for a delinquent patron check. Transactions are accumulated to serve as backup in case of a system malfunction and as basic statistical data. With the final two files, bibliographic and index, the capability for bibliographic search becomes feasible. The bibliographic file normally contains a record for each title held in the library. The record contains both bibliographic and holdings data. Index files can then be constructed to access the bibliographic file by a variety of keys such as call number, piece identification number (PIN), author and title. If bibliographic search capabilities are not to be provided then the bibliographic and index files can be dispensed with. All of these files, with the exception of the transaction log, must be kept on disk storage.

The advantages of an on-line system concern the availability of more up-to-date and more readily accessible data for the libraries'

staff and patrons. All of the advantages attributable to batch or hybrid systems are also realized here although the investment in equipment is larger. In addition, voluminous daily printouts are done away with. The status data is up to date within a second or two and can conveniently be accessed through the use of a terminal. Additionally, the status data is available to the transaction processing programs for error checking purposes. Thus the inclusion of reserve book room operations becomes entirely feasible. The capability for on-line update of the bibliographic records is also available. Errors can be corrected and new items added to the master files immediately. Finally the facility for making bibliographic searches is only feasible with an on-line system. Printouts sorted by various keys could be provided under a batch or hybrid system but would be voluminous in size, expensive to print, and unwieldly to use.

The disadvantages of an on-line system are two-fold; costs are higher, and use of the system is lost when the central computer is out of service. Communications facilities are required as well as additional core memory and disk storage equipment not normally associated with batch or hybrid systems. Also, on-line programs tend to be more complex. Development and maintenance costs are therefore higher than with a batch or hybrid system.

Data was gathered on the on-line systems now in operation at Ohio State, Bucknell, Eastern Illinois, and Northwestern Universities, and systems being planned at the University of Chicago, the University of Illinois and the State University of New York at Albany.

DATA COLLECTION TECHNOLOGIES

Parallel to the task of investigating the variety of existing circulation systems, an evaluation of the various methods of capturing patron and item transaction data in machine readable form was made. Data capture is a very important aspect of any system as it is an operation repeated a great number of times, involving a large clerical workload, and is probably the major source of inaccuracies in a system. Three basic data capture technologies are now in use in libraries: manual keyboarding, the reading of patron passports and book cards containing punches, and the reading of bar-encoded labels attached to the patron identification and the item itself. The use of magnetic stripes for identification is a new technology which has not yet been utilized in a library circulation system.

Keyboarding of data, typically a patron's social security number and a book call number, appears to be both slower and more susceptible to error than the other two methods discussed below. Only the Ohio

State system uses keyboarding at its prime method of data entry, although all systems utilize keyboarding to a certain extent for such activities as status and bibliographic searches, telephone renewals, saves, etc., where both the patron and item identifiers are not physically present or when the terminal being used is malfunctioning. Ohio State has not experienced a serious data error rate with keyboard entry while the use of this method allows them to utilize the same terminal for both searching and data collection functions. One specific problem with the Ohio State method of data entry occurs when the operator must key-in a call number to identify an item. The call number is not always readily identifiable, as it must include volume and copy number. Pre-recorded information on a book card or label would solve this problem.

A large number of the systems observed utilized punched passports and book-cards with a keyboard available as a secondary data entry method. The specially designed terminals needed to read the passports and book cards are more expensive than the general purpose terminals needed for keyboarding. Data accuracy is high and in most cases there is an improvement in the speed of data entry. The disadvantages of working with book cards are (1) the need to initially locate each item to insert the proper card into it and (2) the possibility of book cards being switched or lost. Northwestern spent 4.4 cents to insert a book card as compared to 1.1 cents to punch the card.

Use of bar-encoded labels is not yet widespread. Light pens, used to read the labels, are offered by Pitney Bowes, Singer, National Cash Register, and Plessey of England. This is a rapidly growing field, with such firms as Wards and Sears beginning to utilize this technology for point of sale data collection. Two commercial firms (Checkpoint, Inc. and Computer Library Services, Inc.) are offering systems utilizing light pens with systems already installed or under serious consideration at Rockford Public Library, Cleveland Public Library, Providence Public Library, Indianapolis Public Library, the Widener Library at Harvard University, Villanova University, Carleton University in Ottawa, Camden Borough of London, Sutton Borough of London, and Loughborough University in England. In addition, in house developments are under way at the State University of New York, the University of South Carolina, and the University of Chicago. Ohio State is also investigating this technology for incorporation into their system. Bar-encoded labels offer the same advantages as book cards with the added improvements of even faster data recording, cheaper terminals and permanent adhesion of the label to the specific item. The Bursar has been contacted concerning modification of the current passport. The passport has been redesigned to accomodate a bar-encoded label and will require only a minor change in procedures to affix the label to the passport.

DESCRIPTION CF PROPOSED SYSTEM

The design team feels strongly that an on-line system should be implemented, primarily to improve the library services to students and faculty and to better utilize the resources the Purdue Libraries and Audio-Visual Center already possess. In lieu of a comprehensive on-line system, the redesign of the current manual systems is the next best course of action to pursue. There is little evidence to indicate that a batch or hybrid system would offer significant service improvements, although more complete management data would be made available and some clerical time would be saved.

As indicated above there are a number of on-line systems now in operation. They range from the skeletal (Northwestern), handling only the basic circulation, statistics gathering, and status inquiry tasks, to the sophisticated (Ohio State) where extensive bibliographic searching capabilities have been implemented. To obtain the maximum improvement in services, the bibliographic searching function from multiple locations should be strongly emphasized. The Ohio State system best fills this requirement as well as meeting most of the design considerations and the objectives. It should be noted that the current scheduling system operated by the Audio-Visual Center will not be replaced by the OSU Circulation System. It is recommended that adoption of the OSU Circulation System include its modification to include the use of light pens for basic data recording tasks, the handling of Reserve Book Room and AVC short term loan operations, and the use of an arbitrarily assigned Piece Identification Number (PIN) to identify individual physical items.

To this point, basic system designs and technologies for data recording have been discussed and one specific system, including significant modifications, recommended. The Ohio State system, and the modifications thereto, will now be discussed in more detail. The needed files will be discussed, each basic function will be briefly described and depicted on a flow chart, sample output will be provided, hardware and software requirements will be stated, and advantages and problems discussed.

OSU SYSTEM FILES

The Chio State system requires bibliographic data, search key indices, a transaction log, and patron data to operate. Appendix G lists the data fields found in each of the files and Appendix O describes the plan for creating these records here at Purdue. The bibliographic records are of course a representation of the shelf list. The system requires that the complete shelf list be on-line. Circulation data is transient in that it reflects only the current charges and saves. Search key indices are needed to access the proper bibliographic records when doing author, title, PIN, and call number searches. The transaction log is simply a device used to record all on-line transactions for backup and statistical purposes. Patron data is needed for verifying telephone charges and printing notices to patrons.

OSU SYSTEM FUNCTIONS

Checkouts will be accomplished by reading with a light pen the patron's passport and then the label on the item or items to be checked out. Error checks will be made to see that the item is not already charged out, does not have any circulation restrictions on it, and does not have a save on it. A successful transaction will result in a new record being created in the circulation data file and a ticket being printed which serves as a date due slip and allows the patron tc leave the library with the item. When checking out multiple items tc an individual, the passport will need to be read only once. See Apperdix H for a depiction of this function and Appendix I for an example of the resultant printout. Checkouts can be handled over the telephone, in which case the patron's identification number and the item's label number (or other identification) must be keyed in. As a check, the patron's data record may be called up and the address data verified over the telephone.

Checkin is even simpler. All that need be done is scan the item label with the light pen and dispose of the date due slip. The computer will notify the operator of the error condition where no charge record exists on the circulation file or of the hold condition where a save exists for the item. A successful checkin will delete the record from the circulation file except when the data is needed for printing of availability notices. Again see Appendices H and I.

Renewals are accomplished by keying in patron and item identification. If a save exists, the transaction will not be

completed. A completed renewal results in a new date due slip. The computer will check to see that a charge record already exists on the circulation file and that renewals are valid for this particular item. Please see Appendices H and I.

Saves are accomplished in person or over the telephone by keying in the title and patron identification numbers. The computer will check that a charge record exists and that there are no restrictions on placing saves on the item. The recorded save data will be used to print recall and save notices, and to catch items at checkin time. Recall notices are automatically printed when a save for a class reserve collection is placed or when a save is placed on an item which has been on loan to a faculty member for more than three weeks. See Appendices H and I.

Snags are handled by keying in the PIN number and changing the bibliographic record to reflect the new status. Snag lists are then produced and should the item be checked in or out, the terminal operator will be notified of the snag status. See Appendices H and I.

The Ohio State system has the facility for fines accounting. Pending a policy change, this facility will not be used.

Records in the patron file can be changed and new ones added in an on-line mode. All necessary data is keyed in and the new record is displayed to the terminal operator for verification before the patron file is permanently changed. See Appendices H and I.

The above functions are those handled by most circulation systems, manual or automated. The real strength of the Ohio State system lies in the bibliographic services offered. Three types of searches are available; patron search, general search, and detailed search.

The patron search requires that either the identification number or a search key consisting of the first 4 characters of the patron's last name and the first 5 characters of the first name be entered. The result is a display of the patron's name, local address, and status. The display is useful for verifying information when the transaction is taking place over the telephone and for file maintenance tasks. There is no indication of what items a person has charged to them at this time, although the eventual display of such data is envisioned. See Appendices H and I.

A general search utilizes a search key made up of a portion of the author and/or title. An author search utilizes the first 4 characters of the author's last name. A title search for a monograph utilizes the first 5 characters of the first significant word in the title. A title search for a serial utilizes 9 characters, 4 from the first and 5 from the second significant word in the title. Finally, the general search can be executed using author and title data, 4 characters of

author and 5 characters of title in combination. The result is a display of 1-10 lines of data, each representing an entry in the bibliographic file which satisfies the search key. See Appendices H and I. Additional lines of data can be called up if more than 10 hits are made. (In practice this occurs a small fraction of one percent of the time.) Title, author, line number, date of publication and number of hits are displayed.

A detailed search may be entered utilizing call number, PIN, or line number (line number refering to the response from a general search). The results in all three cases are the same, detailed bibliographic, holdings, and, if desired, circulation information about a single entry in the bibliographic file is displayed. See Appendices H and I.

In addition to all of the above functions, the system handles the printing of overdue notices, save notices, and recall notices automatically in a batch mode. Data on the transaction log file along with counts of batch operations is available for summarization into management reports.

When installed here at Purdue, the system will serve all campus libraries. Terminals, cathode ray tubes equipped with light pens, will be located at the sites shown in Appendix N. The Telephone Center listed will be a replacement for the catalog information service of the second floor reference desk. Inquiries there will be handled immediately by making general and specific searches utilizing a CRT terminal. If the patron so chooses, the item will be checked out to him. This results in the circulation file being properly updated, a message being printed at the location holding the item, and the item itself being held for pickup or mailed to a campus location.

OSU SYSTEM INTERFACES

The system as outlined above will need to interface with other systems inside and outside of the University. It is anticipated that Purdue will one day be a member of a bibliographic center such as the Ohio College Library Center (OCLC) and so obtain automated cataloging services. Therefore, as is being done at Ohio State, records of items which Purdue catalogs at the bibliographic center would be returned to Purdue on magnetic tape to be entered into the circulation system bibliographic file. In the meantime monographs will be handled by converting new catalog cards by keying and serials handled by automatically transferring data on new titles and holdings from the Purdue Serials Catalog to the circulation bibliographic file. The other major interface needed is with the ADPC Personnel and Student

Record Systems computer files containing data on staff and student addresses. This data will be periodically loaded into the circulation system patron file and used for preparing notices and verifying patron data when executing transactions over the telephone. While not an electronic interface, coordination with the Bursar's Office is needed to create a machine-readable passport. Tests have been made to check the readability of a passport containing a bar-encoded label representing a person's social security number, the results of which were most favorable.

OSU SYSTEM SOFTWARE

The programs needed to operate the circulation system are available from Ohio State University for the cost of reproducing the necessary magnetic tapes and documentation and training Purdue's data processing personnel at Columbus. The on-line programs are written in assembly language and consist of over 100 modules while the approximately 80 batch programs are written in PL-1 and assembly language. TCAM is used as the on-line terminal control program. Initially the on-line programs will be used as they stand except for modifications needed to handle PIN, light pen terminals and reserve book and AVC operations. All three modifications appear to be feasible on the basis of experiences at the State University of New York (SUNY) at Albany and a review of the coding of the existing OSU programs.

OSU SYSTEM EQUIPMENT

As shown in the equipment and communication lines configuration (Appendix N), a mini-computer will be located in the library to serve as a communication lines concentrator. A significant amount of applications software will need to be written to handle error checking, message re-formatting, and system backup functions. Basic software such as the operating system and communications handler will be obtained from the hardware vendor. In addition to economic considerations this approach will allow the OSU software to remain largely unchanged by keeping the message formats it receives the same even though new terminals and data collection equipment are being used.

The equipment configuration (Appendix N) shows both ADPC and Library requirements. Much of the ADPC equipment is already installed although 256K of core memory, two spindles of 3330 disk storage, one

high speed modem, and one line set for the 3705 communications controller must be added to handle the OSU circulation system.

Rescheduling of ADPC's operations will also be necessary as teleprocessing services are needed for 104 hours per week, including weekend operations. The additional shifts will be available using existing personnel on an overtime basis.

All of the library equipment shown in Appendix N remains to be ordered. The terminals to be used are of two types: CRT's with attached light pen and twelve column printer, and ordinary CRT's. Currently no CRT-light-pen-printer terminals are being manufactured as a product line item. Fortunately the University of Chicago has begun the process of acquiring such equipment from an independent supplier, Cozzens and Cudahy of Chicago. Cozzens and Cudahy will supply the engineering work necessary to interface a Beehive CRT terminal, a 12 column printer, and a Pitney Bowes light pen to form an integrated terminal. They are already an authorized Beehive representative and will offer maintenance on the complete terminal. If the integrated terminal does not materialize, then freestanding terminals must be utilized at the cost of extra communications lines and terminating equipment. (While this would increase the cost of the hardware slightly, there would be no functional differences in the equipment.) An indication of their applicability to library systems is that Beehive terminals have been selected by OCLC as replacements for their present equipment.

The various terminals will be connected to the mini-computer over telephone lines or where feasible, directly wired to reduce the cost of the communications equipment needed. The mini-computer will initially serve as a programable controller by checking and assembling data from the terminals, communicating with ADPC's computer, and routing return messages to the proper terminals. Besides reducing communications equipment costs and the resources required on the ADPC computer to support the system, use of the mini-computer will allow many, if not all, of the program changes needed to handle the new terminals and data collection equipment to be isolated in the mini-computer. Thus, the OSU software can remain intact and be compatible with the version in use at OSU. The mini-computer will require a console, punched tape reader and punch, and disk storage in order to operate properly. Communications between ADPC's 3705 communications controller and the mini-computer will be handled over a single high speed bi-synchronous communications line.

FILE CONVERSION

An important part of the system will of course be the bibliographic, circulation, and patron files stored on disk at ADPC. Fortunately up to date patron data exists in the Student Record and Personnel Systems which can be reformatted for the Libraries use. To avoid software changes to the OSU system, the Student Record and Personnel address files will be periodically loaded into the circulation system patron file rather than used directly. At the time the system becomes operational, existing checkout, save, etc. records from the manual system will be allowed to wither away rather than being converted and loaded into the circulation file. Conversion of the shelf list will be a major undertaking. It is estimated that 550,000 bibliographic file records will have to be created to completely convert the shelf list. Monographs will require keyboard conversion while the serials data will be automatically transferred from the Purdue Serials Catalog System. In addition, audio-visual entries will be automatically converted from the Audio-Visual Center Catalog System. A method for converting the shelf list is discussed in Appendix O. In Appendix G the fields required in the OSU bibliographic file are listed. These are minimum requirements. As the incremental cost for converting additional fields from the shelf list at this time should be much less than the cost of going back through the shelf list for additional data, future needs must be planned for now. LC card number, ISSN, and ISBN are definitely needed to allow our file to be automatically matched to other files external to the University (principally COBICIL). Possible uses for the file include production of a revised Purdue Serials Catalog, searching of new orders by the Acquisitions Department, production of a book catalog, and merging with the anticipated COBICIL data base for purposes of inter-library loan. A special report will specify in detail what additional fields, and in what format, will be converted. Considering that the present OCLC data uses full MARC records, it is likely that the fields we convert will be in MARC format although not all fields needed for a complete MARC record will be converted. The skeleton record should be acceptable to COBICIL. In order to handle an expanded record without modifying the OSU software immediately, it is likely that an interim magnetic tape file will be created and maintainted to hold all converted data and new cataloging data, with only the required fields being stripped from it to form OSU bibliographic records.

FUTURE MODIFICATIONS

The project and system described to this point encompass the initial implementation phase here at Purdue. In order to keep the project manageable and spread development costs over several years, certain system modifications which seem desirable will be delayed. These modifications include:

1. Restructuring the bibliographic record to add those fields needed for order searching and status inquiry, production of the Purdue Serials Catalog, and production of a book catalog.

2. Rewriting of programs to allow direct use of the Student Record and Personnel systems address files.

3. Development of an interface with the Registrar and/or Bursar to automate the handling of student record encumbrances (or fines, if desired).

4. Improvement of the general search algorithm to reduce the mean number of hits on a search. The OCLC 3-1-1-1 title algorithm and 3-3 author/title algorithm will serve as models for this modification.

5. Creation of a delinquent patron file to be used by the mini-computer to check all patron transactions against.

6. Programming of the mini-computer to serve as backup to ADPC's machine. The mini-computer will handle the spooling of transactions and restarts for system outages.

7. On-line update of the bibliographic file.

8. Expansion of the terminal screen paging facilities for both the general and detailed searches.

9. Optional receipt of a list of all material charged to a patron in response to a patron inquiry.

10. Provision for access to other data bases from any Library circulation terminal through use of the mini-computer as a dialing and switching device (while still allowing the terminal to be used for circulation). Some of the data bases which could be made available include COBICIL, the New York Times Data Bank, ERIC, CAIN, NTIS, MEDLINE, TOXICON, Chemical Abstract Condensates, and Engineering Index, to name but a few.

11. Provide limited access to the Purdue Libraries/AVC shelflist to other institutions through the existing Indiana TWX network and the anticipated COBICIL network. Utilization of existing SUVCN and IHETS communications lines will also be considered.

12. Implementation of self-service circulation terminals with limited functions available which will allow patrons at least the ability to check out materials by themselves.

13. Develop a system of reports and methods of access to the statistical data accumulated by the circulation system. IHRU's special interest in this area of development must be recognized.

14. Implementation of a booking and scheduling function for audio-visual materials and projection services.

The system described here is a viable one. It has been in continuous operation at OSU for almost three years. The State University of New York administrative group at Albany has already chosen the OSU system for installation and is well along with the task of converting the programs to handle PIN. Talks with the SUNY and OSU system people reveal a strong desire to cooperate on future system enhancements. To date OSU has been very cooperative by supplying full documentation and program listings at reproduction costs, conducting a Purdue shelf list--OSU data base--OCLC data base overlap study at no cost to Purdue, aiding in an on-line demonstration of their system here on campus at the 1971 Indiana Seminar on Information Networks, and answering a multitude of questions. Adoption of the OSU system represents a unique opportunity to acquire a sophisticated, state of the art system at minimum cost and to truly cooperate with other universities on future enhancements.

ECONOMIC EVALUATION AND IMPLEMENTATION PLAN

In order to justify the continuation of development and implementation of the proposed circulation system, Purdue must be as certain as possible that the contribution of the system to the University community will justify the assignment of University funds to this purpose. The achievable potential of automation must be clear as an operating service as opposed to a developmental project insofar as it is based on existing rather than potential technologies. To this end, we propose adaptation of an existing system to the requirements of the University rather than the in-house duplication of developmental effort, time, and funds already expended elsewhere.

This section examines the probable impact of an automated circulation system on the Purdue community and sets forth a plan for its implementation. It attempts to present a frank, balanced, and comprehensive discussion. In the long run, this type of discussion, even in its disagreeable aspects, will better serve the purposes of the Libraries/AVC and the University.

The main goal of a library is simple enough. It is to make recorded information available to patrons without undue restrictions on access or ultimate use. In achieving this end, though, four major complications arise.

The first is in judging which small fraction of currently published materials should be selected for inclusion in the library's collection. The second is in finding and acquiring those materials. The third is in devising an index or catalog to make the materials and their contents available, and in aiding location of materials needed by scholars that are among those not acquired by the University. The fourth is in assuring that these materials are safely maintained and lent under conditions so no individual precludes reasonable use by others and so materials are preserved for future members of the community. While an automated circulation system might appear to address this last area exclusively, it will be seen that a significant impact on the other problem areas may be derived as well.

ANALYSIS OF TANGIBLE COSTS AND BENEFITS

Developmental Time and Costs

Overview Study			
System Analyst Time	1094 hrs. at 11.30	$12,362.20	
Customer Time	300 hrs. at 7.00	2,100.00	
			$14,462.20
System Design			
System Analyst Time	1260 hrs. at 11.30	$14,238.00	
Programmer Time	840 hrs. at 11.30	9,492.00	
Customer Time	420 hrs. at 7.00	2,940.00	
			26,670.00
Programming			
System Analyst Time	990 hrs. at 11.30	$11,187.00	
Programmer Time	660 hrs. at 11.30	7,458.00	
Customer Time	330 hrs. at 7.00	2,310.00	
			20,955.00
Implementation			
System Analyst Time	630 hrs. at 11.30	$7,119.00	
Programmer Time	420 hrs. at 11.30	4,746.00	
Customer Time	210 hrs. at 7.00	1,470.00	
	780 hrs. at 3.72	2,901.60	
			16,236.60
Review and Evaluation			
System Analyst Time	165 hrs. at 11.30	$1,864.50	
Customer Time	165 hrs. at 7.00	1,155.00	
			3,019.50
Total Developmental Cost			$81,343.30

Capital Costs

Computer Hardware (refer to Appendix N for a description of the required hardware and a discussion of procurement options)	$234,118.79	
Shelf List Conversion (a discussion of this project is presented as Appendix O)	72,205.65	
Total Capital Costs		$306,324.44
Total Developmental and Capital Costs		$387,667.74

Annual Recurring Costs

Figures are shown for the first year only. The reader is invited to refer to Appendix J for a more detailed presentation of total costs over the first six years of operation of the proposed system.

Current System		
Computer Costs	$0.00	
Customer Direct Labor Cost	329,416.02	
Supplies Cost	9,796.40	
		$339,212.42
Proposed System		
Computer Costs	$114,163.56	
Customer Direct Labor Cost	180,318.89	
		294,482.45
Net Savings in Annual Recurring Cost (first year)		$44,729.97

ANALYSIS OF INTANGIBLE BENEFITS

As with most systems, certain benefits accrue from the automation of the library's circulation activities to which no real monetary value can be attached. In the following discussion they are classified into four categories: (1) Improvements to Traditional Circulation Functions; (2) Provision of Services not feasible with a Manual System; (3) Implications for Management; and (4) Benefits Deriving From Future Enhancements to the Proposed System.

Improvement of Traditional Circulation Functions

As has been pointed out, the proposed system benefits from increased speed and reduced clerical workload. It offers, additionally, several significant advantages over the current potpourri of manual systems. These include:

1. Improved accuracy of circulation records. Ohio State noticed a marked improvement over the 15% error rate of their old Key-Sort system.

2. Removal of the psychological barrier to library use presented by the large amount of effort required of the library patron.

3. Presentation to the patron of a consistent interface with the circulation systems of all libraries at Purdue, reducing reluctance to use "someone else's" departmental library.

4. Closer coordination of the Save and Checkin functions, insuring that a patron's requests are honored and with minimal delay.

Provision of Services not Feasible with a Manual System

Owing principally to the vastly different nature of automated and manual files, several services can be provided by the proposed system which are virtually impossible with any manual system. These services generally relate to making a file, in this case the bibliographic and circulation files, accessible from many locations through on-line terminals, with access being provided via multiple keys. The implications of this type of service include:

1. The up-to-date status of all copies of all titles held in the collection is available at each terminal and through the Telephone Center. Not only can the patron determine if a book is held by Purdue, but he can determine which library holds the volume and whether or not the volume is currently available.

2. Not only is the user able to search the bibliographic file from remote terminals, but, if the material is available, it may be checked out, or, if not available, saved for the patron, again saving his time.

3. A closely related advantage is the ability to save by title rather than by copy, regardless of the geographical dispersion of the copies, which also reduces the time required to service the request.

4. Security of both bibliographic and circulation data will be enhanced, the automated versions of these files being far less easily tampered with than the present trays of cards, and much more easily restored should vandalism occur.

5. Improved control of the collection is possible at several points. Overdue notices are produced automatically and with the most current addresses available. The circulation of materials to be placed on reserve can be restricted almost immediately, often before the book is physically removed from the shelves. The system may also insure that materials returned are promptly routed to the proper

location, and a receipt of the checkin is available for the patron desiring one.

6. Employee morale can be expected to improve under the proposed system for two main reasons. First, personnel will be involved with a technically advanced system and, second, a formal training program will be instituted. Serveral schools report reduced turnover of circulation personnel and OSU reports that their clerical personnel are very enthusiastic about the system.

Implications for Management

As previously stated in this report, circulation statistics are generally recognized as the best available indicator of library use. The Libraries/AVC currently spend $12,812.62 annually for circulation statistics perceived as only 80% accurate.* As to accuracy, the reader is invited to compare the figures in Appendix A (source: various annual reports), Appendix K (source: Libraries and AVC Cost Study, August, 1971), and Appendix L (source: Book Fund Allocation Study, IMRU, 1973). That the proposed system would collect these statistics more accurately should be obvious, for this is the sort of routine clerical task to which electronic data processing techniques were first applied.

A more subtle benefit derived from the automated collection of circulation data is the depth of data obtainable, which far exceeds anything possible in a manual system. For the first time library management will have an accurate, detailed picture of their patrons, and of the use these patrons make of the library resources. With such a view, a more timely and beneficial allocation of the libraries' resources can be made to improve services without the expenditure of additional funds, and the impact of expending additional funds can be more accurately determined.

Potential allocation/re-allocation decisions for which relevant, accurate data would be available include:

1. Consolidation of special collections or departmental libraries where usage is either too low to warrant maintenance of separate collections or where two or more collections are seen to service the same group of patrons. The University of Pennsylvania has taken such actions based largely on data derived from an automated circulation system.

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*"Study of Purdue Library Statistics", IMRU, July, 1972.

2. Regulate the hours during which a library is open, and the staffing level during the open hours. Ohio State University has adjusted staffing levels in several locations as a result of data made available through the circulation system.

3. Improved allocation of funds available for the acquisition of materials. Of the schools visited, Eastern Illinois University made specific reference to having made such a re-allocation based on data from their automated circulation system. The recent IMRU Book Fund Allocation Study is an example of the type of work possible at Purdue in this area, although better data is obviously needed before any major decisions can be based on such statistics.

4. Improved allocation of the current collection is possible since who is using what will be known to the system. The shifting of materials among the various libraries and secondary storage facilities, and the "automatic" weeding of shelves, are all possible outcomes of work in this area.

5. By recording the actual loan lengths for each title, it will become possible to regulate the loan period and amount of duplication of each item to achieve a desired level of availability.

Benefits Deriving From Future Enhancements to the Proposed System

Certain desirable enhancements to the proposed system will not be made initially, owing to a desire to provide the Libraries/AVC with an operational system within a reasonable time. The anticipated benefits deriving from their eventual implementation include:

1. Improvement of collection availability through creation of a "delinquent patron" status and restricting the library privileges of persons so identified. Research tends to indicate that this is a technique superior to fining in ensuring timely return of materials. A closely related function, the ability to produce lists of materials on loan by patron for use in end of semester clearance/encumbrance processing, will provide similar benefits.

2. Further reduction of clerical effort required to provide library services will be derived from the automation of encumbrance notice preparation, installation of self-service circulation stations, and modifications to produce the Purdue Serials Catalog directly from the bibliographic file.

3. Expansion of the data in the bibliographic file to improve its usefulness to the Acquisitions and Catalog Departments will have the

dual benefits of reducing clerical effort within Technical Processing and providing status inquiry into materials in process as well as on the shelves.

4. Many currently uncataloged materials could be entered into the bibliographic file making them more readily available and simplifying circulation procedures for them. Approximately thirty different types of such material were identified by the Overview Study.

5. Production of a book catalog in hard copy or microfiche, as well as the production of other special lists, such as those of new acquisitions, can be feasibly automated.

6. Portable data recorders are available to read bar-encoded labels in an off-line mode. The use of such devices would streamline inventorying and the collection of certain statistical data tremendously.

SUMMARY OF ECONOMIC EVALUATION

Of the present manual effort expended in circulating materials, it is estimated that .421 Professional, 4.478 Technical Assistant, 15.278 Clerical, and 7.93 Student FTE would be made available. (A detailed comparison of manpower resource expenditures is presented in Appendix M.) While this represents an annual savings of $149,097.13, it will be extremely difficult to realize any cash savings as consolidation of the time saved into a position which can be eliminated is readily accomplished in perhaps only the General Library. This presents a challenge to a creative Library management to devise new procedures which will allow the distribution of work to the departmental libraries and reductions of staff centrally. (The firm and conditional order procedure which moves the burden of bibliographic verification from the Acquisitions Department to the requestor is an example of this type of procedure.)

What, then, does the University gain from the assignment to the Libraries/AVC (on a recurring basis) of an additional $114,000 per year? As pointed out in the sections on benefits, substantial (one is tempted to say quantum) improvements in the substance as well as appearance of library services at Purdue.

Utilization of the library collection, a resource in which the University is investing at an annual rate of $1,320,000, is expected to increase due to the improvement in services offered. Ohio State has reported a sustained 17% annual growth in circulation, and the University of Maryland 20%. In both instances the increase is

attributed by these schools to the automation of the circulation activities. Greater increases than these were reported at Eastern Illinois, although a causal relationship is difficult to establish there due to a tremendous increase in collection size and student population. Accordingly, the figures presented in Appendix J as case 1 reflect a sustained 15% increase in circulation at Purdue. This is a substantially greater proportionate increase in library use than is the $114,000 of the present rate of investment in the collection. Thus, owing principally to its stimulation of library usage, the proposed system represents the most cost beneficial investment in library services possible at the present time.

IMPLEMENTATION PLAN

Listed below are the activities required to implement the proposed system at Purdue. Concurrent with the System Design and Programming phases will be the conversion of the shelf list to machine readable format. A discussion of this project is presented in Appendix O.

I. System Design
28 weeks elapsed time; 3 FTE. (2.5 ADPC, .5 Library)

A. The specification and procurement of the additional hardware, and the installation of at least the mini-computer and one circulation terminal will be necessary during the System Design phase.

B. Two people will require approximately 8 weeks to become familiar with the mini-computer hardware, operating systems and languages. This estimate includes three weeks of formal training for each person.

C. Approximately four weeks of study in Lafayette and four weeks of study in Columbus by two people to become familiar with the OSU software.

D. The final twelve weeks will be spent designing and specifying the necessary modifications to the OSU software, any modifications to the mini-computer software, and writing the System Design Report. The only modifications to be included at this stage are:

1. Access by Piece Identification Number (PIN) (This is the number which will appear on the bar-encoded label attached to the piece.)
2. Class reserve collection (RBR) and Audio-Visual Center over-the-counter operation
3. Light pen use for data collection on Checkout and Checkin
4. Reformatting of the printed tickets from the OSU system to fit the twelve column printer on the

circulation stations.

II. Programming
22 weeks elapsed time; 3 FTE. (2.5 ADPC, .5 Library)

A. Ten weeks elapsed time for two people is estimated as the requirement to code and program test the desired modifications to the OSU software.

B. Four weeks is allowed for any necessary programming of the mini-computer. Two people are to be available for this task.

C. Two people will require eight weeks to system test the modifications.

D. In parallel with the above activities will be the continued conversion of the shelf list, the installation of required hardware, and updating of documentation.

III. Implementation
18 weeks elapsed time; 3 FTE.* (2.5 ADPC, .5 Library)

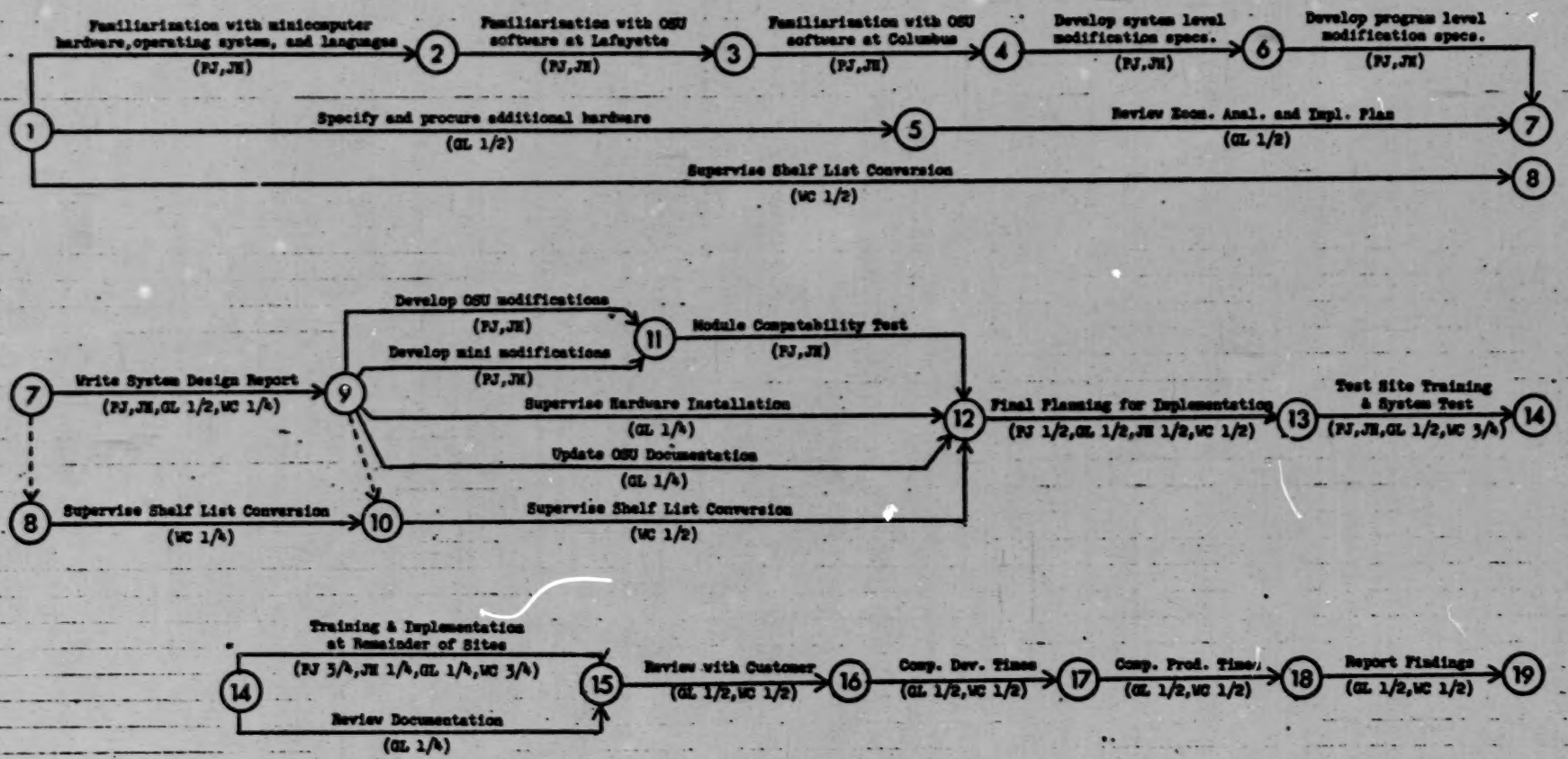
This phase will consist of the conversion of the various libraries to the new system. Based on the experience at Ohio State, four months will be required. In each library the conversion will consist of equipment installation, training, and parallel runs. Training is estimated to require 30 man hours of time per library for operational personnel.

In tandem with the above conversion of the libraries will be the placing of the system in In Production Status (IPS).

IV. Review and Evaluation
11 weeks elapsed time; 1 FTE (.5 ADPC, .5 Library)

A review and evaluation of the project will be made, the results of which will be presented in a formal report.

*exclusive of the Library personnel to be trained



Pert Chart of the Remainder of the Project

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ADMINISTRATIVE DATA PROCESSING CENTER

ACTIVITY & TASK LIST

SYSTEM NAME Library Circulation System (LCS) CUSTOMER Purdue Libraries/AVC REIMBURSABLE

System Code	Act. No.	Task No.	Description	ADPC / Customer	Begin Date	Due Date	Estimated Hours	Estimated Weeks
LOCN	03	07	Familiarization with minicomputer hardware, operating system, and languages. Includes 3 wks. formal training.	480 / 0	4 Mar 74	29 Apr 74	480	8
		07	Familiarization with OSU software - study at Lafayette	240 / 0	29 Apr 74	27 May 74	240	4
		07	Familiarization with OSU software - study at Columbus	240 / 0	27 May 74	24 Jun 74	240	4
		02	Develop System Level spec. for mod. to OSU software	240 / 0	24 Jun 74	22 Jul 74	240	4
		03	Develop Program Level spec. for mod. to OSU software	300 / 0	22 Jul 74	26 Aug 74	300	5
		04	Review Economic Analysis and Implementation Plan	75 / 0	22 Jul 74	26 Aug 74	75	5
		06	Review Designs and write System Design Report	225 / 22.5	26 Aug 74	16 Sep 74	247.5	3
		07	Specify and procure additional hardware	300 / 0	4 Mar 74	22 Jul 74	300	20
		07	Planning for and supervision of Shelf List conversion	0 / 397.5	4 Mar 74	16 Sep 74	397.5	28
	04	01/02	}					
		03/04	} Develop modifications to OSU software	600 / 0	16 Sep 74	23 Dec 74	600	14
		01/02	}					
		03/04	} Develop any necessary mod. to minicomputer software	240 / 0	16 Sep 74	23 Dec 74	240	14
		06	System level test of module compatibility	480 / 0	23 Dec 74	17 Feb 75	480	8

ACTIVITY

01 Preliminary Survey
02 Overview Study
03 System Design
04 Programming
05 Implementation
06 Review & Evaluation
07 Modification

Total ADPC		
Total Customer		
Total		

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ADPC Form 6120
Rev. 11/72

ADMINISTRATIVE DATA PROCESSING CENTER

ACTIVITY & TASK LIST

SYSTEM NAME Library Circulation System (LCS) CUSTOMER Purdue Libraries/AVC REIMBURSABLE

System Code	Act. No.	Task No.	Description	ADPC / Customer	Begin Date	Due Date	Estimated Hours	Estimated Weeks
LOCN	04	05	Update OSU documentation	165 / 0	16 Sep 74	17 Feb 75	165	22
		06	Continued supervision of Shelf List conversion	0 / 330	16 Sep 74	17 Feb 75	330	22
		06	Supervise installation of the remainder of the hardware	165 / 0	16 Sep 74	17 Feb 75	165	22
	05	01	Final planning for implementation	90 / 30	17 Feb 75	3 Mar 75	180	2
		07	Test site - training and system test	600 / 90/30*	3 Mar 75	28 Apr 75	750	8
		04	Training for remainder of libraries - done in 4 groups	360 / 90/750*	28 Apr 75	23 Jun 75	1410	8
		06	Review documentation	60 / 0	28 Apr 75	23 Jun 75	60	8
	06	01	Review with Customer	75 / 75	23 Jun 75	28 Jul 75	150	5
		02	Compare actual and estimated development times	30 / 30	28 Jul 75	11 Aug 75	60	2
		03	Compare actual and estimated production times	30 / 30	11 Aug 75	25 Aug 75	60	2
		04	Document and review findings	30 / 30	25 Aug 75	8 Sep 75	60	2

Total ADPC	4965	79
Total Customer	1905	79
Total	6970	79

ACTIVITY

01 Preliminary Survey
02 Overview Study
03 System Design
04 Programming
05 Implementation
06 Review & Evaluation
07 Modification

* time spent by Customer personnel in formal training sessions

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CIRCULATION STATISTICS

Legend

(library use)
home use

Year	General Library	Departmental Libraries	System Total
1964/65	(482,835) 173,890	(538,018) 136,799	(1,020,853) 310,689
1965/66	(596,462) 192,434	(648,825) 151,880	(1,245,287) 344,314
1966/67	(593,735) 183,355	(763,986) 179,100	(1,357,721) 362,955
1967/68	(627,666) 189,592	(814,085) 191,082	(1,441,751) 380,674
1968/69	(641,799) 182,702	(818,061) 200,684	(1,459,860) 383,386
1969/70	(610,558) 188,322	(782,044) 206,208	(1,459,860) 394,530
1970/71	(661,323) 192,283	(863,665) 238,133	(1,524,988) 430,416
1971/72	(589,875) 189,410	(845,755) 254,754	(1,435,630) 444,164
1972/73	(432,481) 172,327	(834,258) 250,196	(1,266,739) 422,523

Source: Readers' Division, Annual Reports.

BOOK CARD SYSTEM FUNCTIONAL FLOW CHARTS

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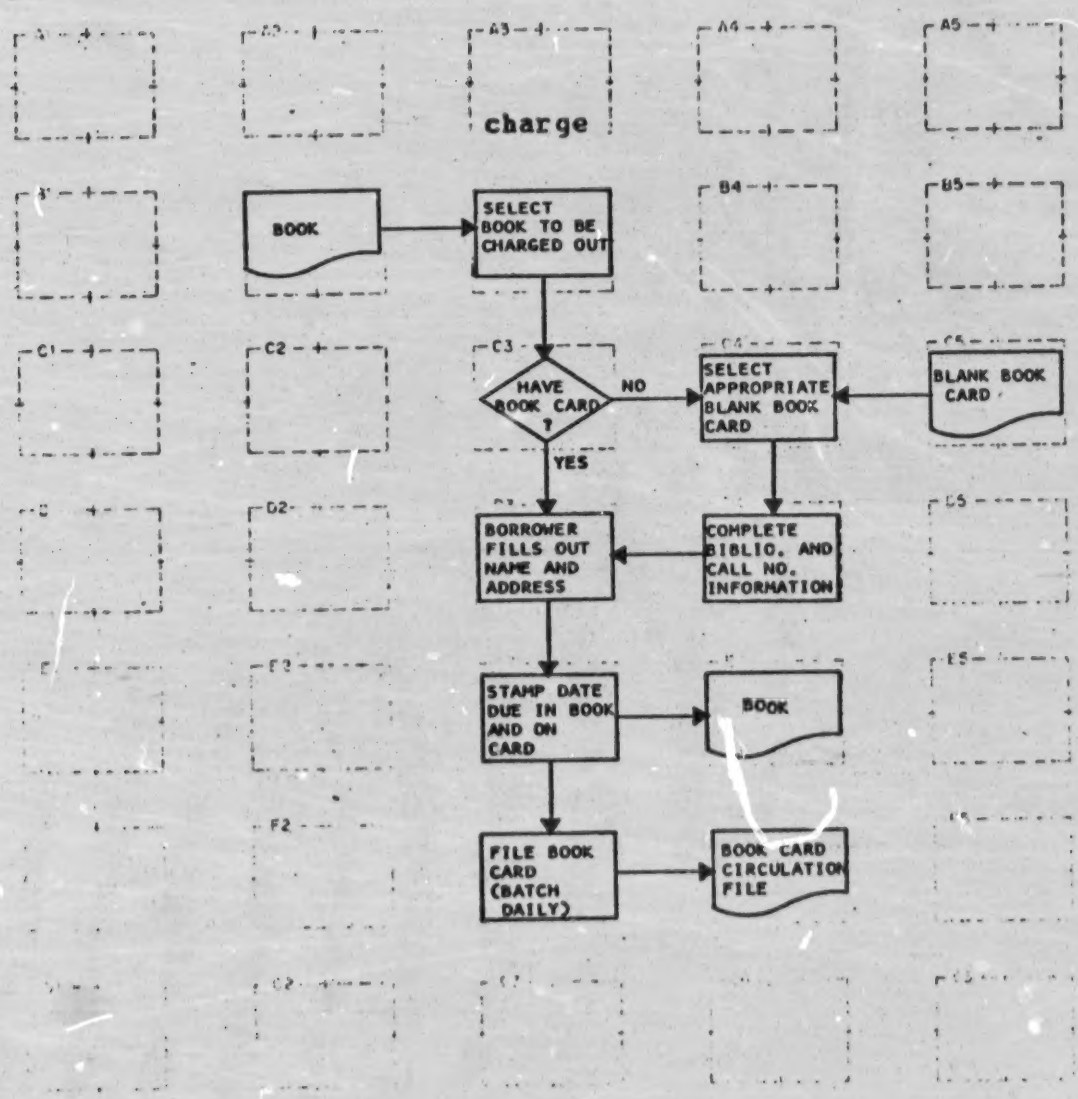

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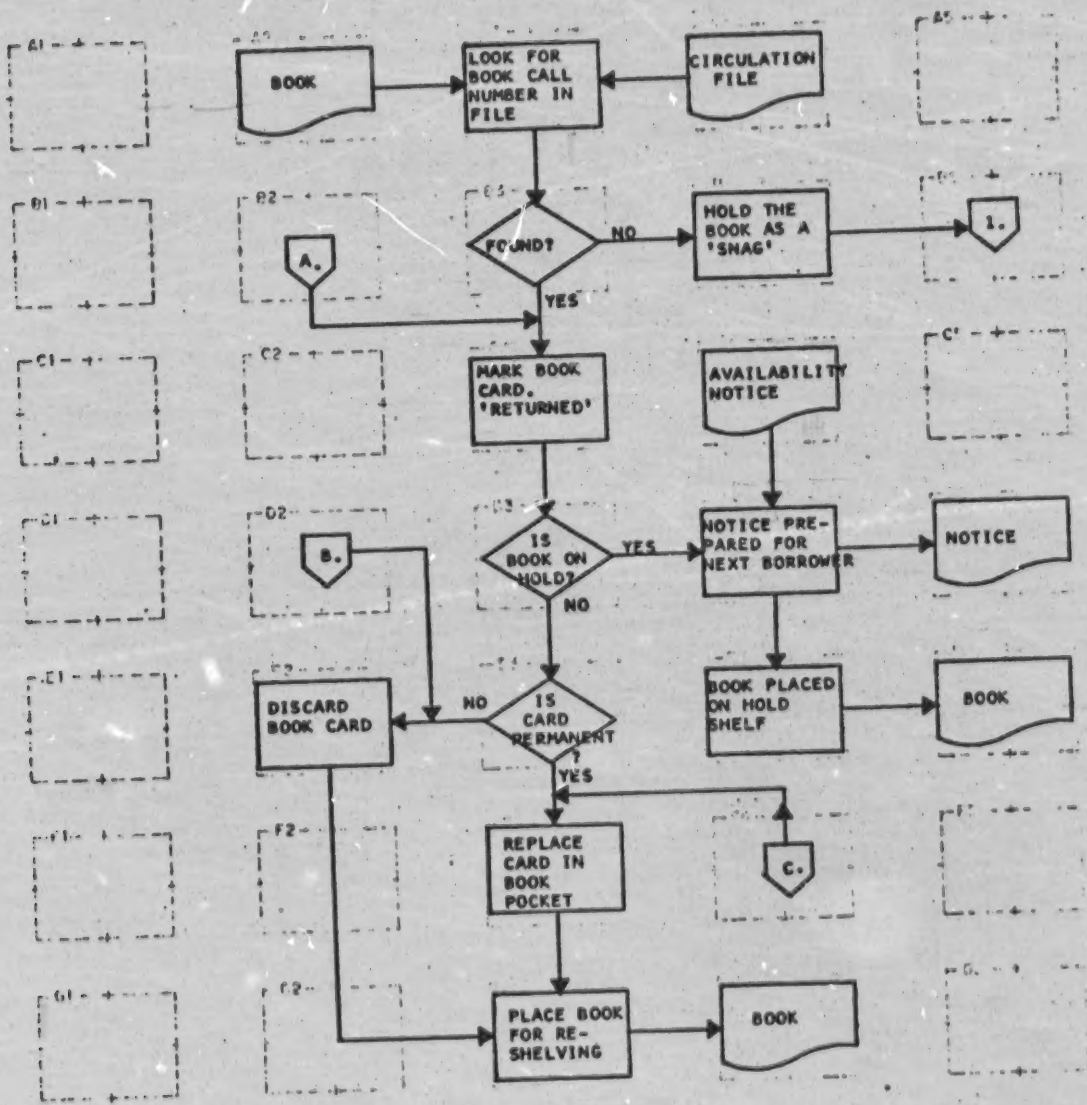

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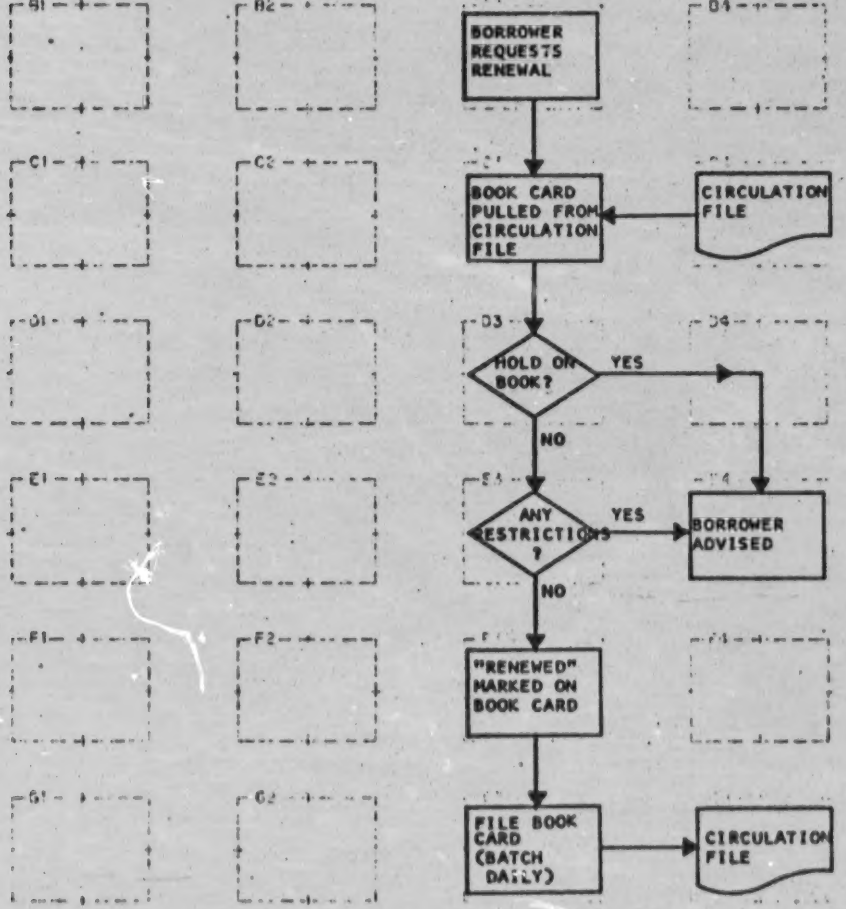
renewal



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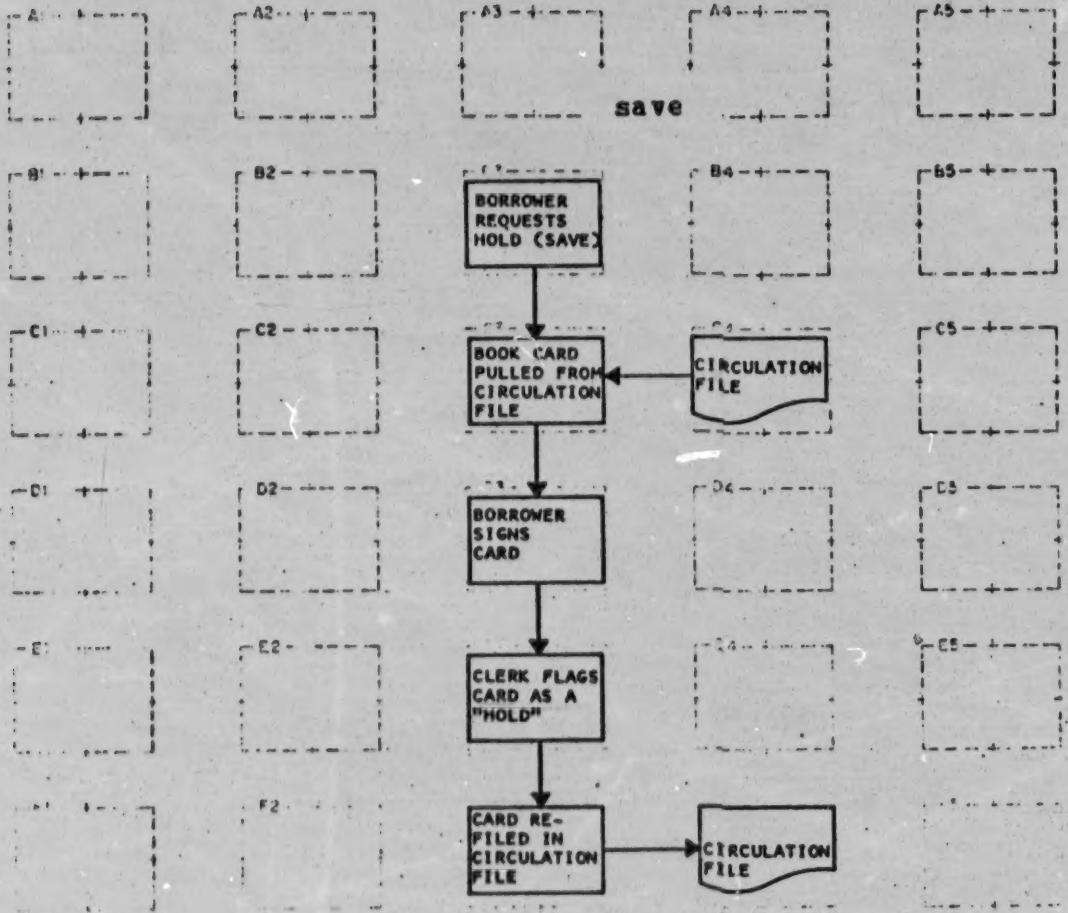

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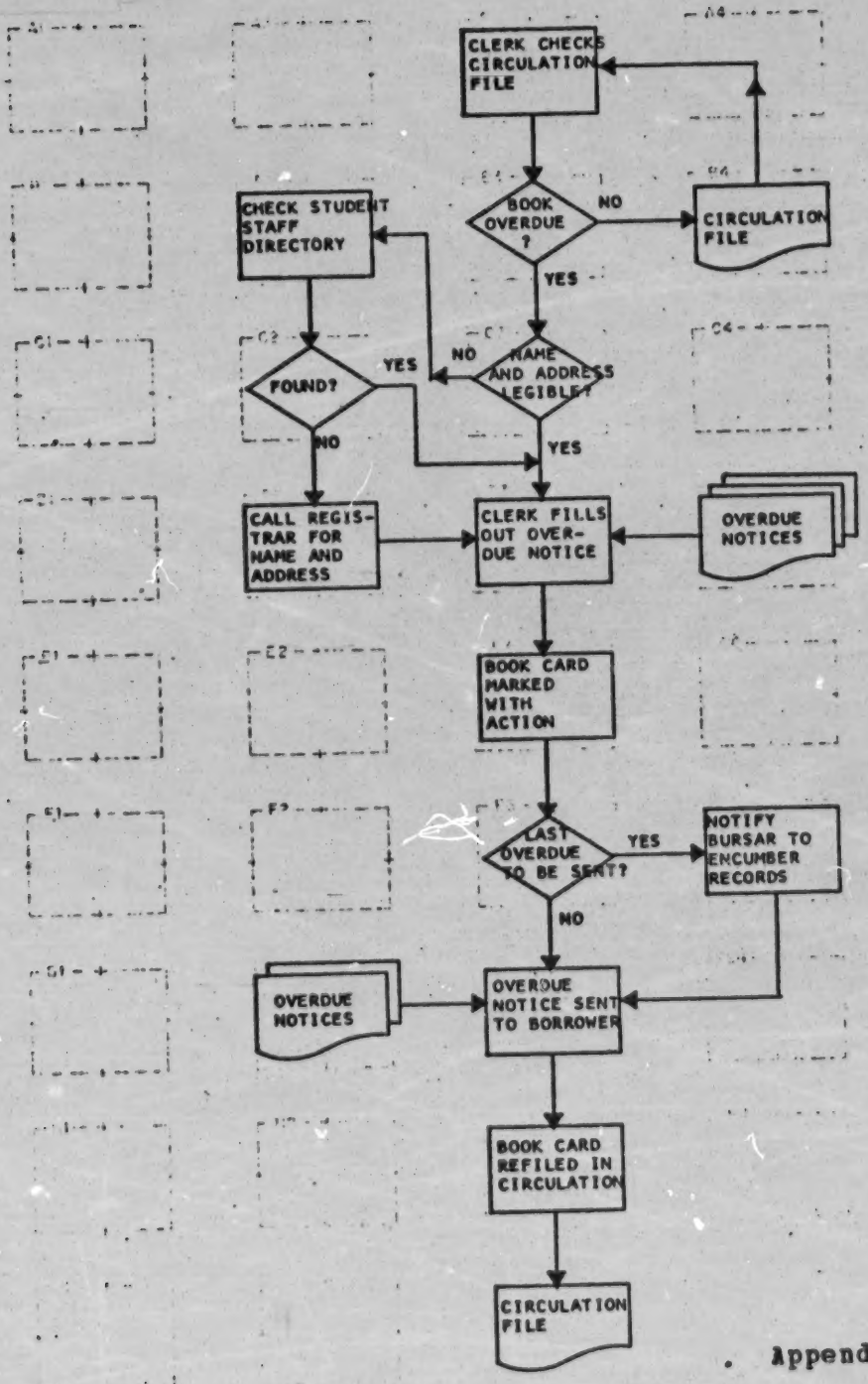
overdue



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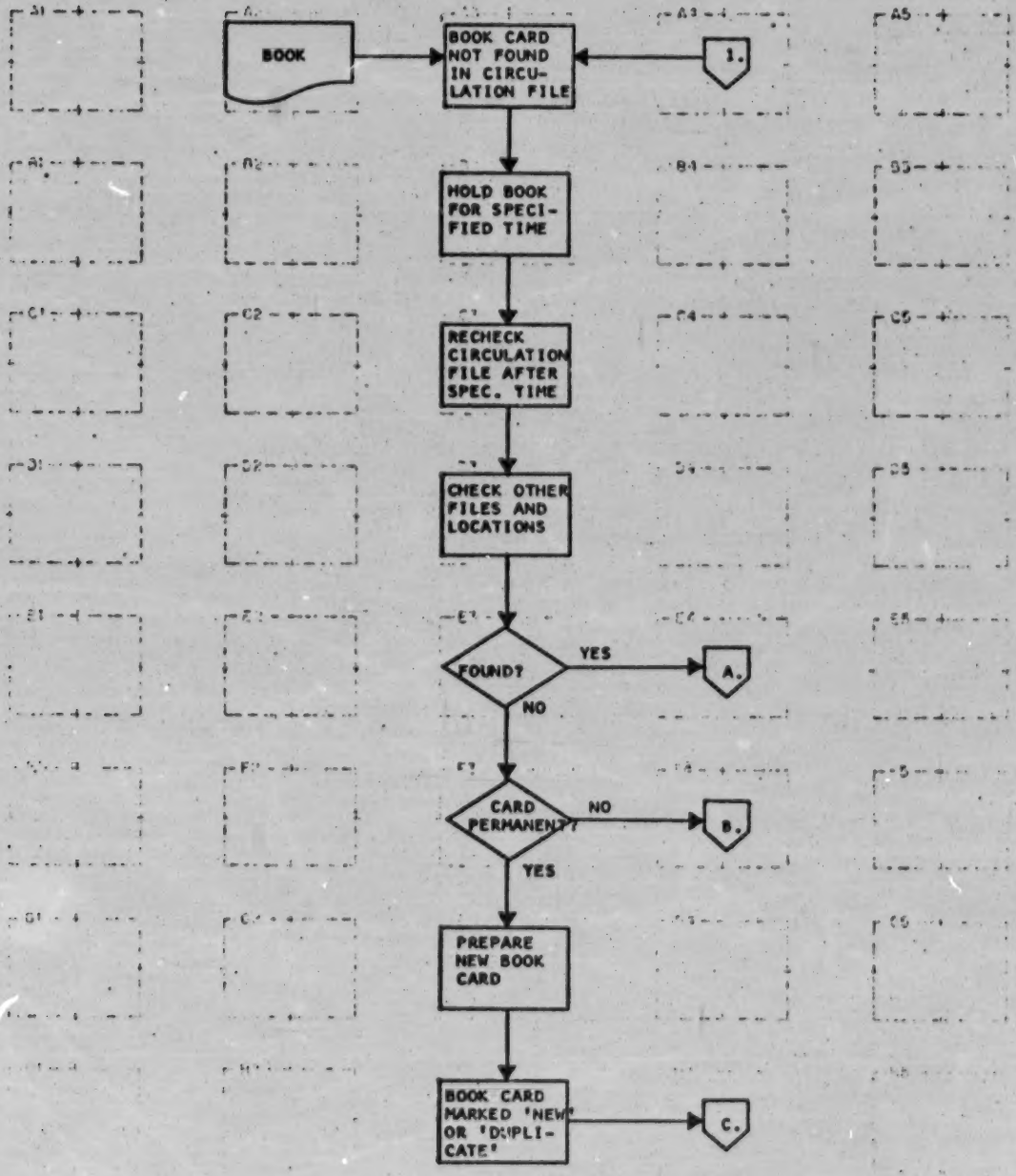
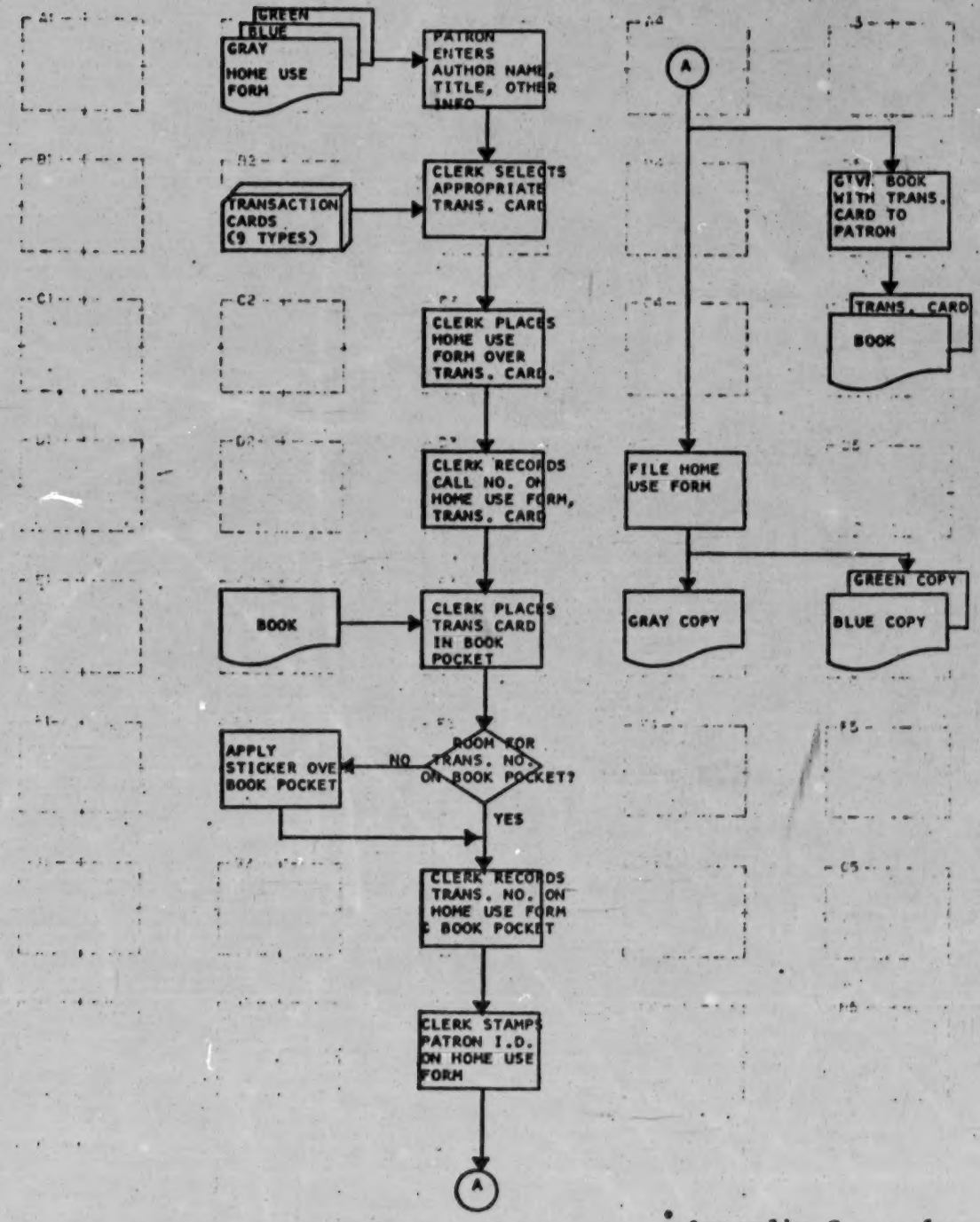


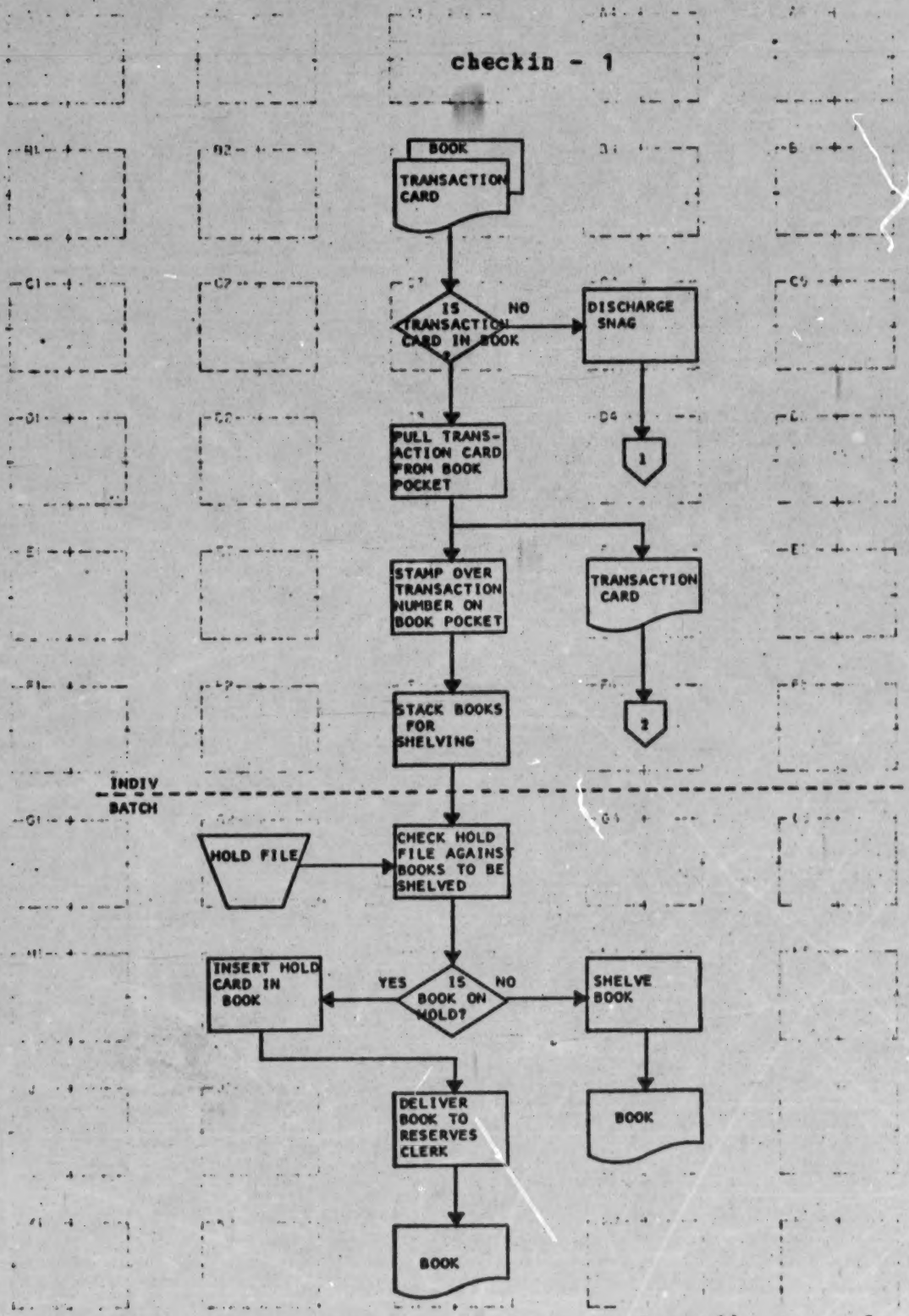
TRANSACTION CARD SYSTEM FUNCTIONAL FLOWCHARTS

BEST COPY AVAILABLE

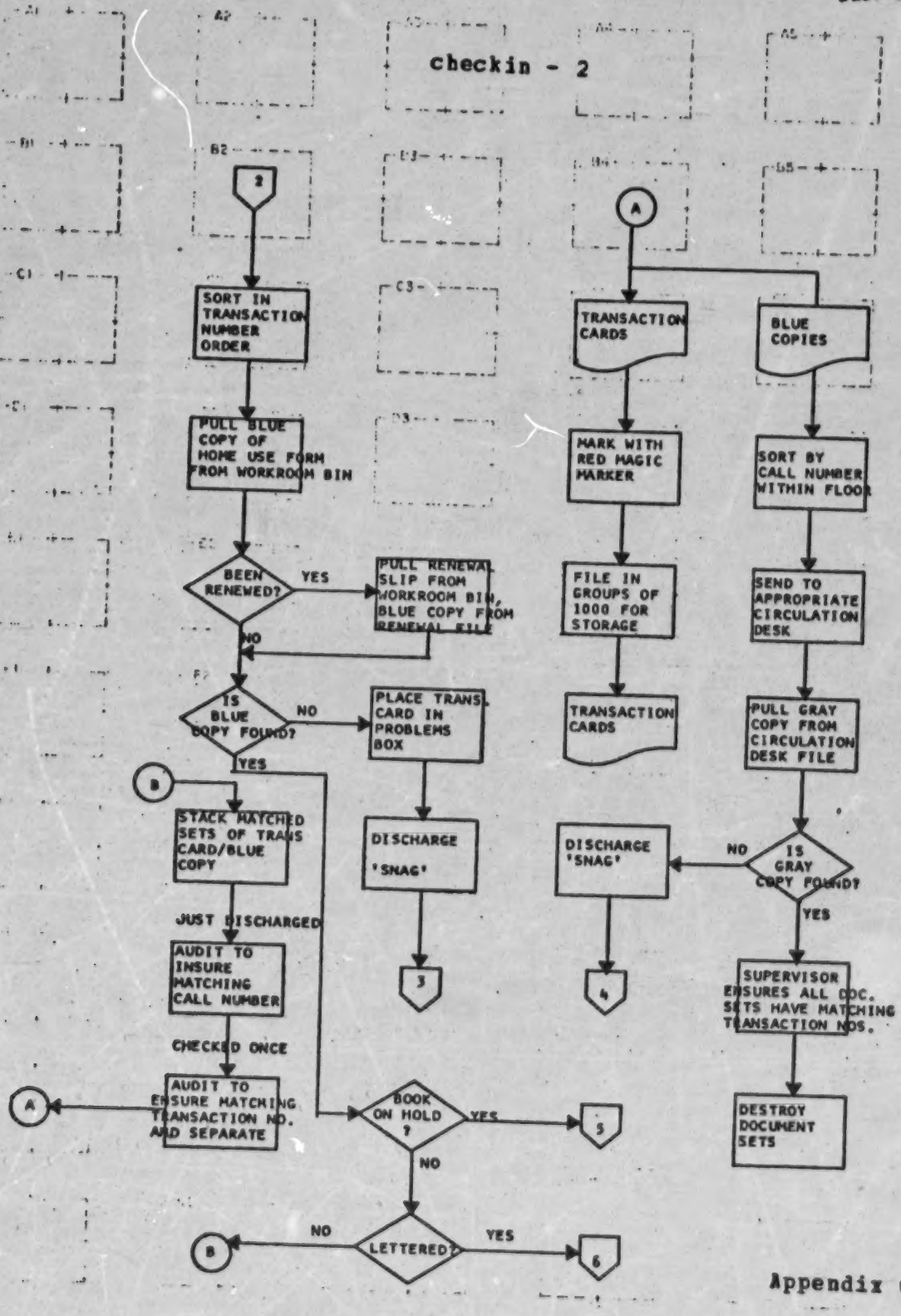
checkout


GREEN
BLUE
GRAY
HOME USE FORM
PATRON ENTERS AUTHOR NAME, TITLE, OTHER INFO
TRANSACTION CARDS (9 TYPES)
CLERK SELECTS APPROPRIATE TRANS. CARD
CLERK PLACES HOME USE FORM OVER TRANS. CARD.
CLERK RECORDS CALL NO. ON HOME USE FORM, TRANS. CARD
BOOK
CLERK PLACES TRANS CARD IN BOOK POCKET
ROOM FOR TRANS. NO. ON BOOK POCKET?
NO
APPLY STICKER OVER BOOK POCKET
YES
CLERK RECORDS TRANS. NO. ON HOME USE FORM & BOOK POCKET
CLERK STAMPS PATRON I.D. ON HOME USE FORM
A
A
GIVE BOOK WITH TRANS. CARD TO PATRON
TRANS. CARD
BOOK
FILE HOME USE FORM
GRAY COPY
GREEN COPY
BLUE COPY

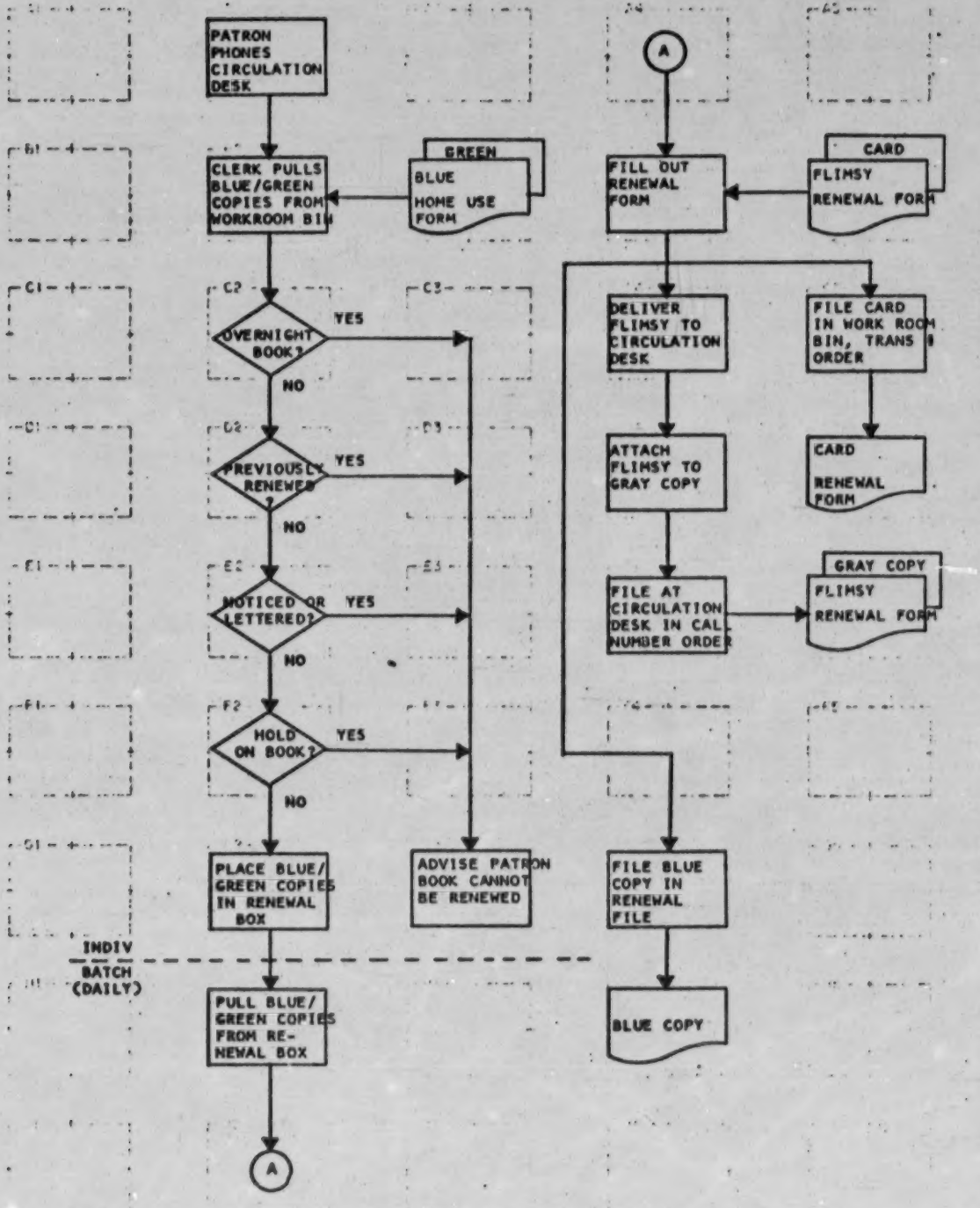
BEST COPY AVAILABLE



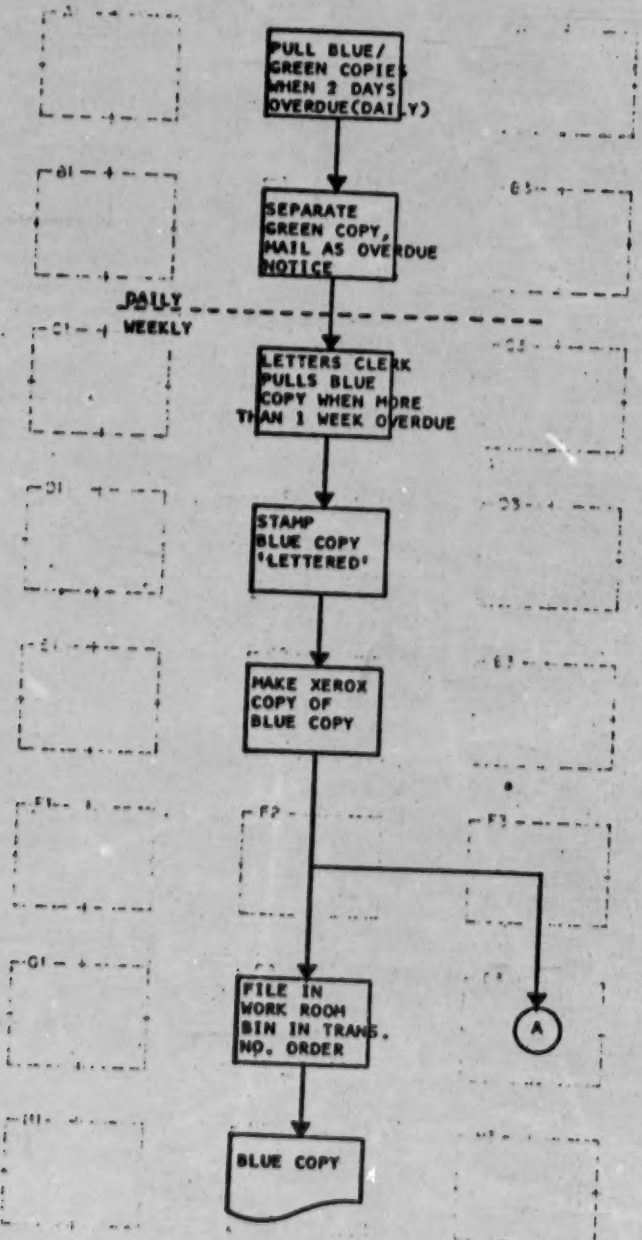
BEST COPY AVAILABLE



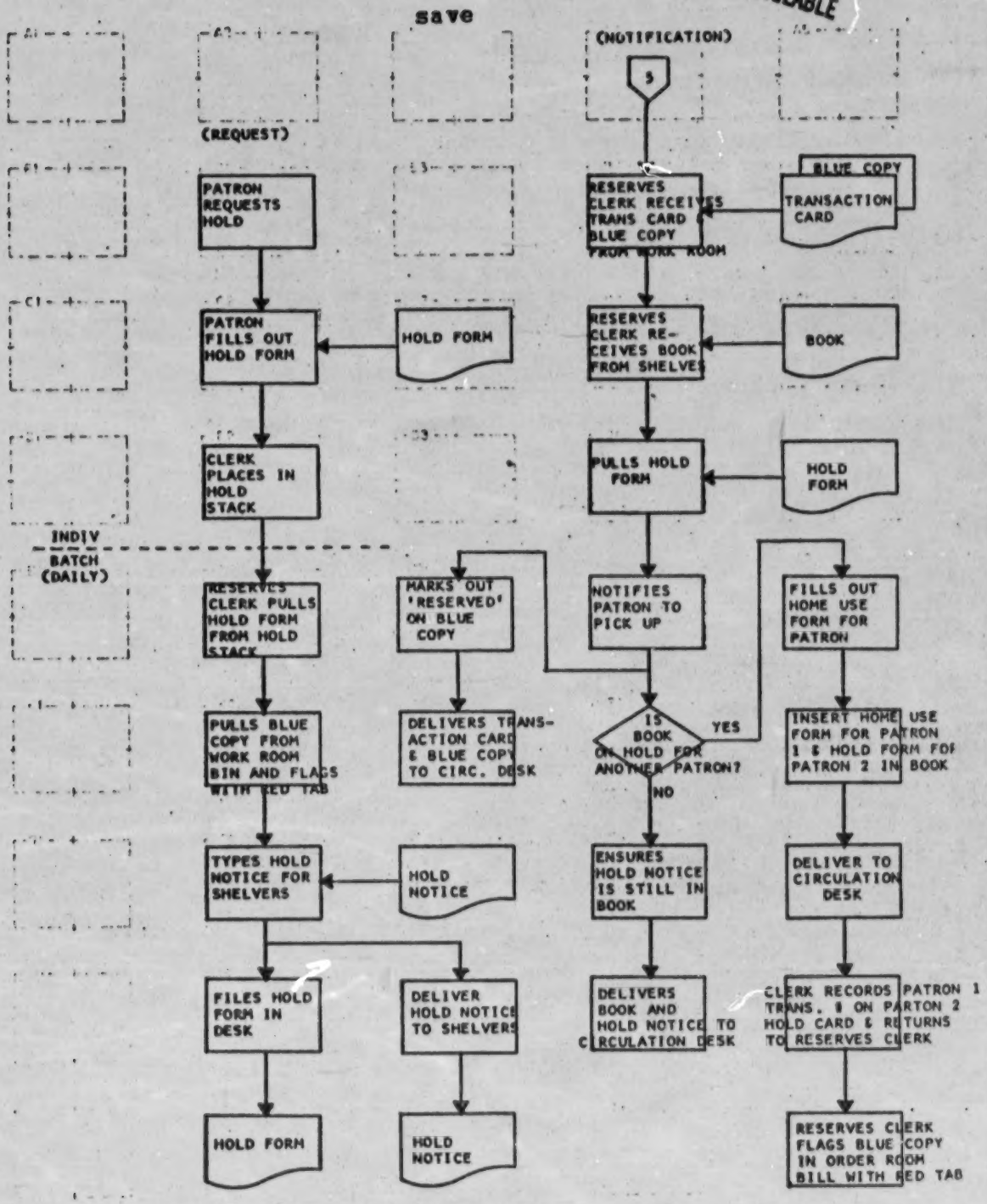
BEST COPY AVAILABLE



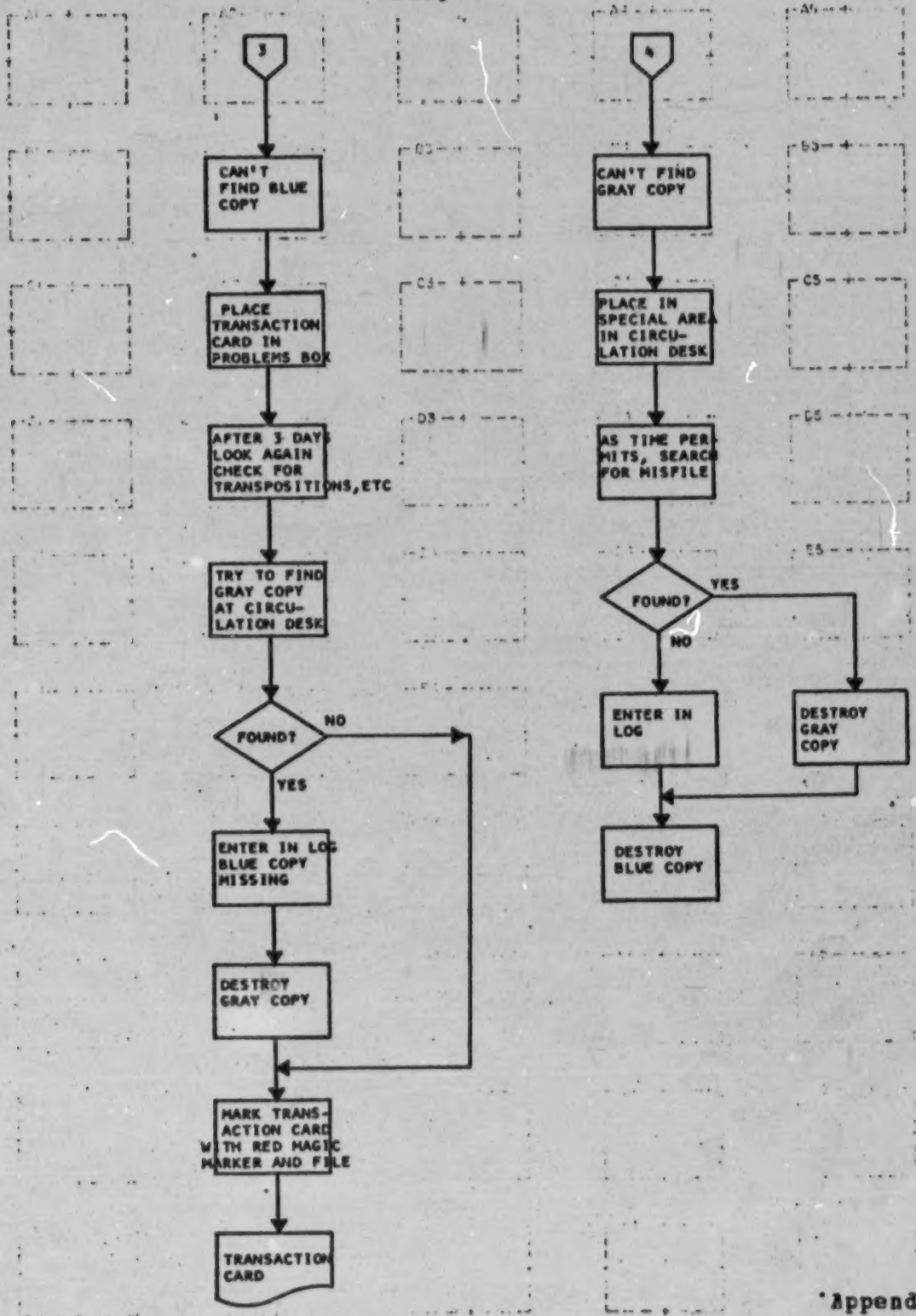
BEST COPY AVAILABLE


PULL BLUE/ GREEN COPIES WHEN 2 DAYS OVERDUE(DAILY)
SEPARATE GREEN COPY, MAIL AS OVERDUE NOTICE
DAILY
WEEKLY
LETTERS CLERK PULLS BLUE COPY WHEN MORE THAN 1 WEEK OVERDUE
STAMP BLUE COPY 'LETTERED'
MAKE XEROX COPY OF BLUE COPY
FILE IN WORK ROOM BIN IN TRANS. NO. ORDER
BLUE COPY
A
A
LETTERS CLERK HOLDS FOR ONE WEEK
SORT BY CALL NO. WITHIN FLOOR
DATE AND ASSIGN SET NO.
SEND TO FLOOR SUPERVISOR
FLOOR SUPERVISOR HOLDS FOR TWO WEEKS
VERIFY-ENSURE ALL INFO IS LEGIBLE, ADD PRICE INFO
SEND LIST TO BURSAR FOR ENCUMBRANCE

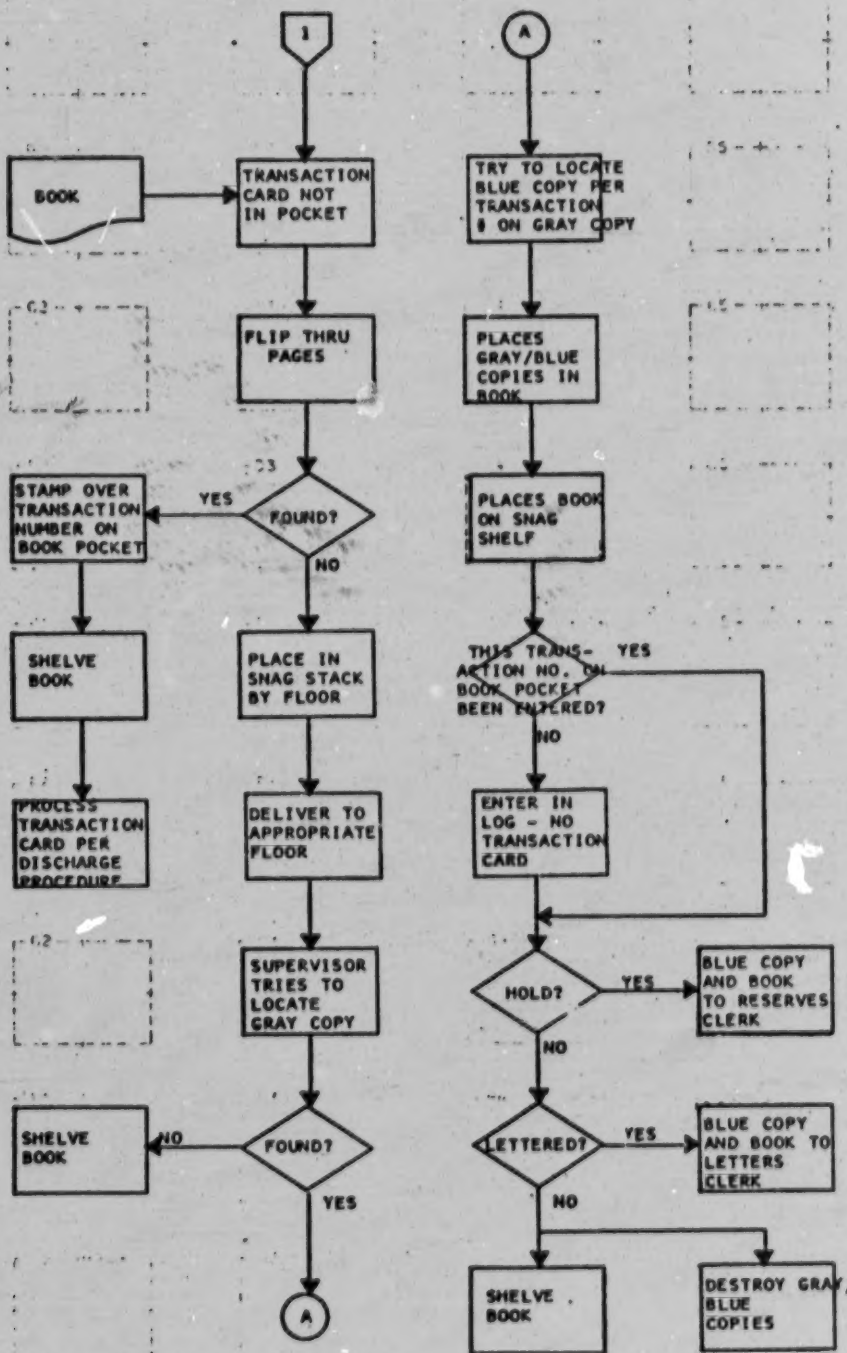
BEST COPY AVAILABLE


save
(REQUEST)
(NOTIFICATION)
5
PATRON REQUESTS HOLD
RESERVES CLERK RECEIVES TRANS CARD & BLUE COPY FROM WORK ROOM
BLUE COPY TRANSACTION CARD
PATRON FILLS OUT HOLD FORM
HOLD FORM
RESERVES CLERK RECEIVES BOOK FROM SHELVES
BOOK
CLERK PLACES IN HOLD STACK
PULLS HOLD FORM
HOLD FORM
INDIV
BATCH (DAILY)
RESERVES CLERK PULLS HOLD FORM FROM HOLD STACK
MARKS OUT 'RESERVED' ON BLUE COPY
NOTIFIES PATRON TO PICK UP
FILLS OUT HOME USE FORM FOR PATRON
PULLS BLUE COPY FROM WORK ROOM BIN AND FLAGS WITH RED TAB
DELIVERS TRANSACTION CARD & BLUE COPY TO CIRC. DESK
IS BOOK ON HOLD FOR ANOTHER PATRON?
YES
NO
INSERT HOME USE FORM FOR PATRON 1 & HOLD FORM FOR PATRON 2 IN BOOK
TYPES HOLD NOTICE FOR SHELVERS
HOLD NOTICE
ENSURES HOLD NOTICE IS STILL IN BOOK
DELIVER TO CIRCULATION DESK
FILES HOLD FORM IN DESK
DELIVER HOLD NOTICE TO SHELVERS
DELIVERS BOOK AND HOLD NOTICE TO CIRCULATION DESK
CLERK RECORDS PATRON 1 TRANS. # ON PARTON 2 HOLD CARD & RETURNS TO RESERVES CLERK
HOLD FORM
HOLD NOTICE
RESERVES CLERK FLAGS BLUE COPY IN ORDER ROOM BILL WITH RED TAB

BEST COPY AVAILABLE



BEST COPY AVAILABLE



LIBRARY SYSTEMS UNIT WORKING PAPERS

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Title	Systems Unit Code Number
Circulation Advisory Group Duties	COS 1/73
Overview Study Plans	COS 2/73
Trip Interview Outline	COS 3/73
Indiana State University Trip Report	COS 4/73
Overview Study Objectives	COS 5/73
Purdue Questionaire Number 1	COS 6/73
Summary of Questionaire Responses	COS 6R/73
University of Illinois Trip Report	COS 7/73
University of Wisconsin at Milwaukee Trip Report	COS 8/73
Northwestern University Trip Report	COS 9/73
Eastern Illinois University Trip Report	COS 10/73
File Conversion Outline	COS 11/73
Implementation Outline	COS 12/73
Ohio State University and OCLC Trip Report	COS 13/73
University of Pennsylvania Trip Report	COS 14/73
Checkpoint Inc. and Temple University Trip Report	COS 15/73
Proposed System Functional Outline	COS 16/73
ADPC Machine Time Costing Statistics	COS 17/73
University of Chicago Trip Report	COS 18/73
Purdue Questionaire Number 2	COS 19/73

Overview Study Report	COS 20/73
Libraries Ranked by Home Use	COS 21/73
A Recommended Allocation of Terminal Equipment	COS 22/73
Priority of Modifications to the OSU System	COS 23/73
Summarization of Research into the Specificity of Truncated Search Keys	COS 24/73

LIBRARY AUTOMATION LITERATURE SOURCES

1. American Society for Information Science. Annual Meetings, Proceedings. Washington, D.C. Thompson Book Company.

2. Annual Review of Information Science and Technology. Sponsored by the American Society for Information Science. Edited by C. A. Cuadra. New York, New York. John Wiley and Sons, Inc.

3. Aslib Proceedings. London, England. Aslib

4. Avram, H. D., The MARC II Format, a Communications Format for Bibliographic Data. Washington, D.C., Information Systems Office, Library of Congress, 1968.

5. BIBNET. Technical Applications and News Announcements. Reading, Mass., Information Dynamics Corp.

6. CHANNEL, the Newsletter of the New England Library Information Network. Wellesley, Mass., New England Board of Higher Education.

7. College and Research Libraries. Chicago, Ill. Association of College and Research Libraries.

8. Information Science Abstracts. Philadelphia, Pennsylvania. Documentation Abstracts, Inc.

9. Journal of Library Automation. Chicago, Illinois. American Library Association, Information Science and Automation Division.

10. Journal of the American Society for Information Science. Washington, D.C.

11. LARC Newsletter. Tempe, Arizona, The LARC Association.

12. The LARC Reports. Tempe, Arizona. The LARC Association.

13. Library Journal. New York, New York. R. R. Bowker Company.

14. Library of Congress Information Bulletin. Washington, D.C. Card Division, Library of Congress.

15. Library Resources and Technical Services. Richmond, Virginia. Resources and Technical Services Division, American Library Association.

16. Ohic College Library Center. Newsletter. Columbus Ohio. Ohio College Library Center (OCLC).

17. Program: News of Computers in British University Libraries. Aslib.

18. Special Libraries. New York, New York. Special Libraries Asscciation.

19. University of Illinois. Clinic on Library Applications of Data Processing. Proceedings. Champaign, Illinois.

SCHOOLS AND FIRMS CONTACTED

Bucknell University - Lewisburg, Pennsylvania

Eastern Illinois University - Charleston, Illinois

Indiana State University - Terre Haute, Indiana

Ohio College Library Center - Columbus, Ohio

Ohio State University - Columbus, Ohio

San Antonio College - San Antonio, Texas

Stanford University - Palo Alto, California

State University of New York - Albany, New York

Temple University - Philadelphia, Pennsylvania

University of British Columbia - Vancouver, British Columbia

University of California at Irvine - Irvine, California

University of Chicago - Chicago Illinois

University of Illinois - Champaign-Urbana, Illinois

University of Maryland - College Park, Maryland

University of Minnesota - Minneapolis, Minnesota

University of Pennsylvania - Philadelphia, Pennsylvania

University of South Carolina - Columbia, South Carolina

University of Tennessee - Knoxville, Tennessee

University of Wisconsin at Milwaukee - Milwaukee, Wisconsin

Wright State University - Dayton, Ohio

Addressograph Multigraph Corporation - Cleveland, Ohio

Beehive Medical Electronics, Incorporated - Salt Lake City, Utah

Checkpoint, Incorporated - Cherry Hill, New Jersey

Colorado Instruments Division of Mohawk Data Sciences
Broomfield, Colorado

Computer Library Services, Incorporated - Wellesley Hills, Mass.

Cozzens / Cudahy, Incorporated - Chicago, Illinois

Digital Equipment Corporation - Maynard, Massachusetts

Friden Division, The Singer Company - San Leandro, California

International Business Machines, Incorporated - Armonk, New York

Laminex, Incorporated - Cleveland, Ohio

Monarch Marking Systems Division of Pitney Bowes, Incorporated
Dayton, Ohio

Polaroid Corporation - Cambridge, Massachusetts

Standard Register Company - Dayton, Ohio

OSU DATA FIELDS

BIBLIOGRAPHIC RECORD

Title number -- three characters (binary format --a maximum value of 16,777,216)
Publication date -- four characters
Flags and Indicators -- one character
- Serial indicator
- Non-English indicator
- Oversize book indicator
- Portfolio case indicator
- Monographic set indicator
- Spares (3)

Call Number -- from 0 to 255 characters
Main Entry -- from 0 to 255 characters
Title -- from 0 to 255 characters
LC card number -- from 0 to 255 characters
Holdings -- 8 characters of information about each copy of a title (for up to 309 copies)
- Condition code (loan length etc.) -- 1 character
- Location code -- 1 character
- Volume number -- 3 characters
- Copy number -- 3 characters

Portfolio case number -- 0 or 4 characters

CIRCULATION/SAVE RECORD

Patron identification -- 9 characters
Special save flags -- 1 character
- Repair
- Bindery
- Cataloging
- Interlibrary loan
- Spares (4)

Record type indicator -- 1 character
Title number (same as in the Bibliographic File)
Holding entry (the holdings field from the Bibliographic File record for this copy)
Dates -- 12 characters
- Date checked out or save placed
- Due date or not used

PATRON RECORD

Patron identification number -- 9 characters
Patron class (student, faculty, etc.) -- 1 character
Expiration date -- 6 characters
Patron name -- 30 characters
Address type (campus or off campus) -- 1 character
Address line 1 -- 30 characters
Address line 2 -- 30 characters
Address line 3 -- 30 characters

PIN INDEX RECORD

Piece Identification Number -- 4 characters (binary format)
Bibliographic record address -- 4 characters
Volume and copy data -- 6 characters

AUTHOR/TITLE INDEX RECORD

Algorithm -- 9 characters
Record type -- 1 character
- Author/Title
- Title
- Name

Bibliographic record address -- 4 characters

TRANSACTION LOG RECORD

Record type code -- 2 characters
Transaction date (Julian) -- 5 characters
Transaction time -- 4 characters
Terminal address -- 8 characters
Circulation File record -- 28 characters

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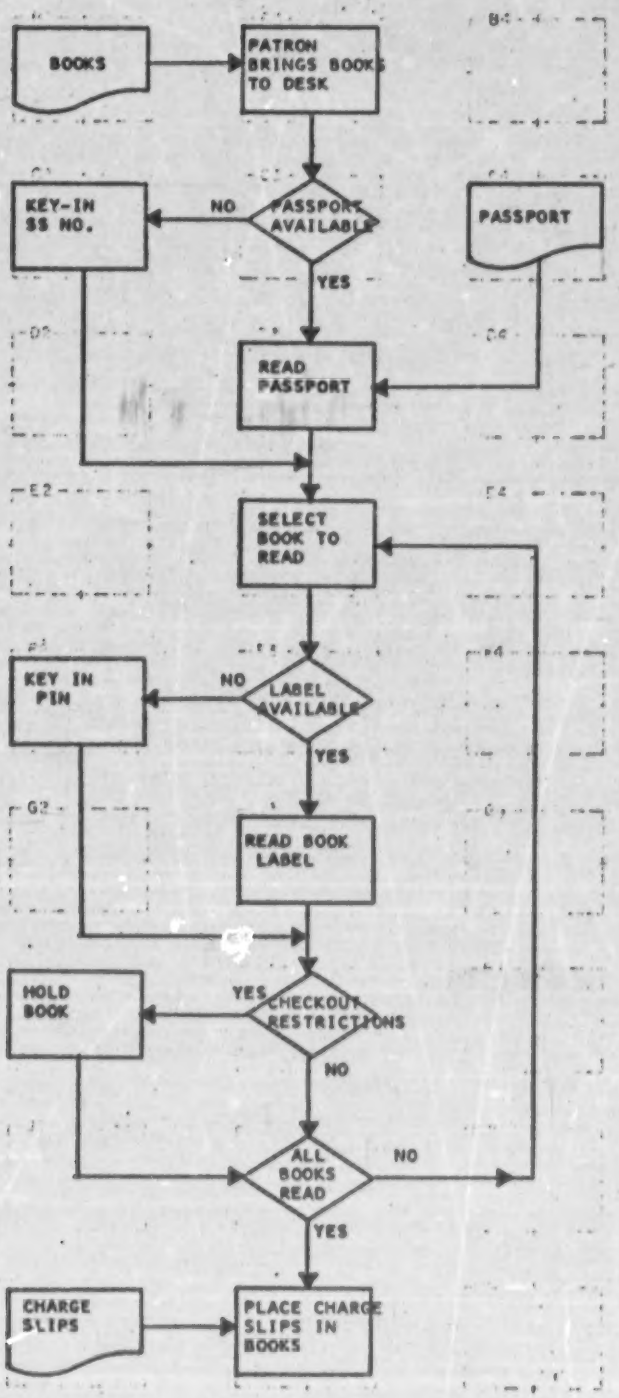
OSU SYSTEM FUNCTIONAL FLOW CHARTS

checkout



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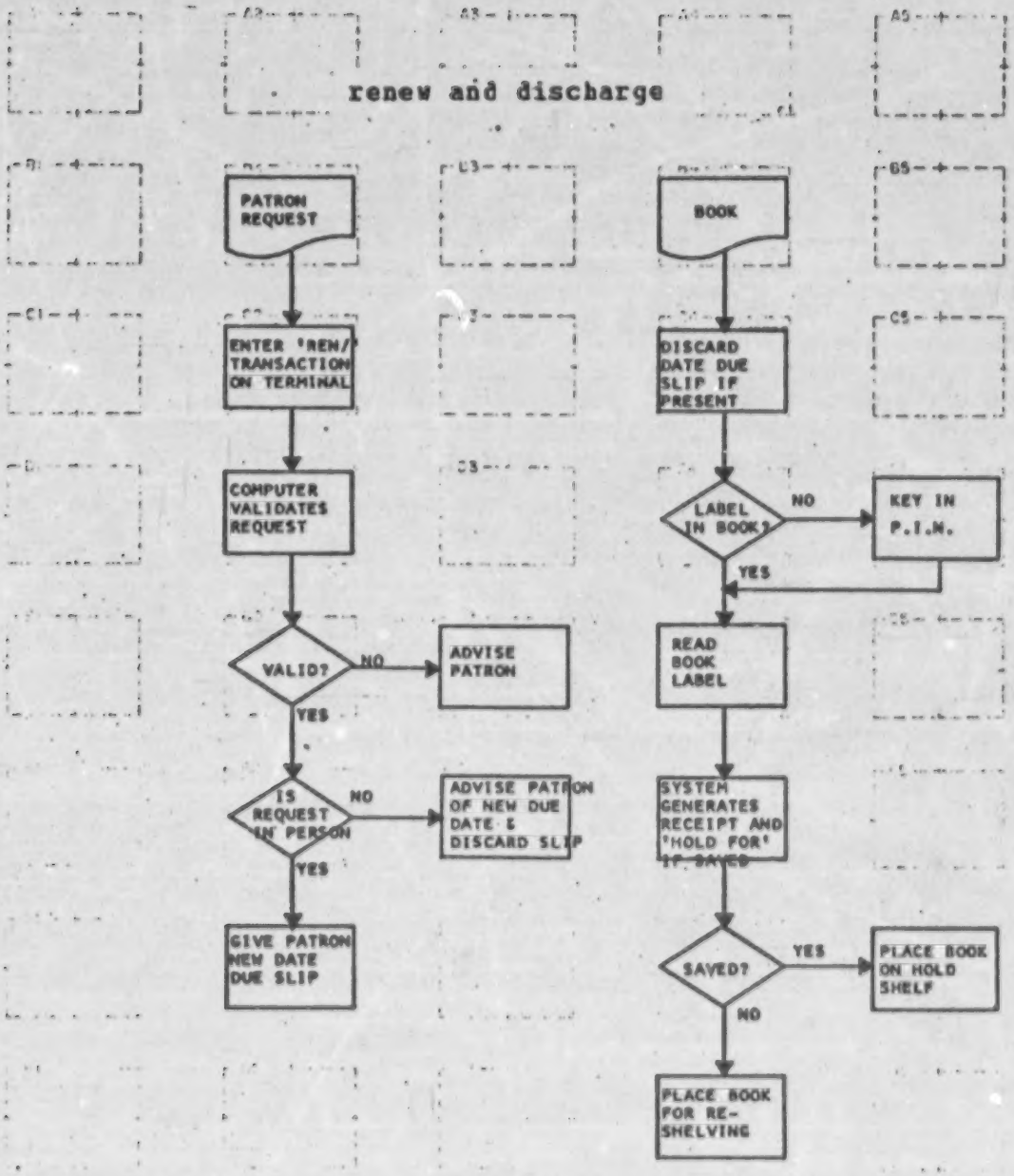
renew and discharge



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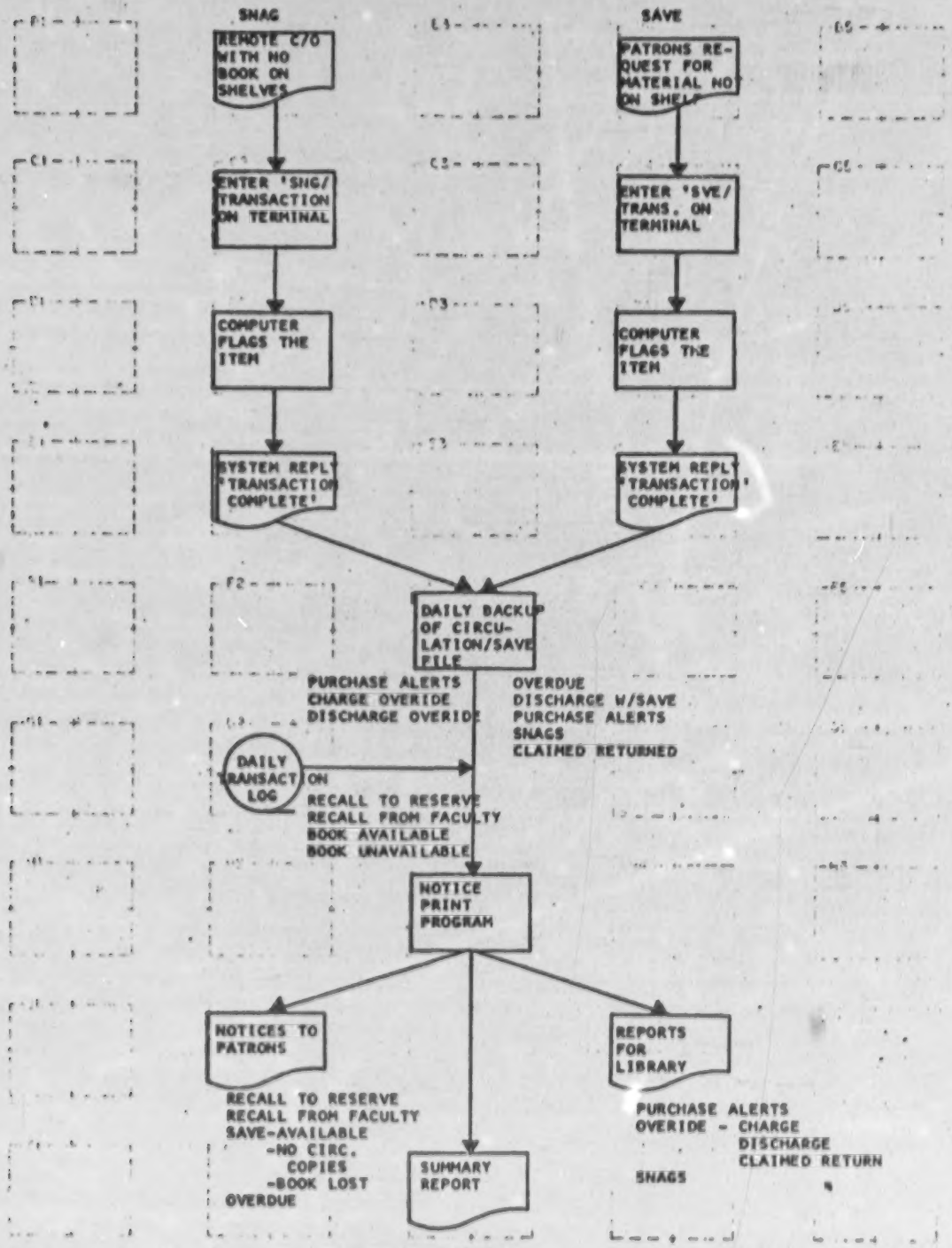
snag, overdue, and save



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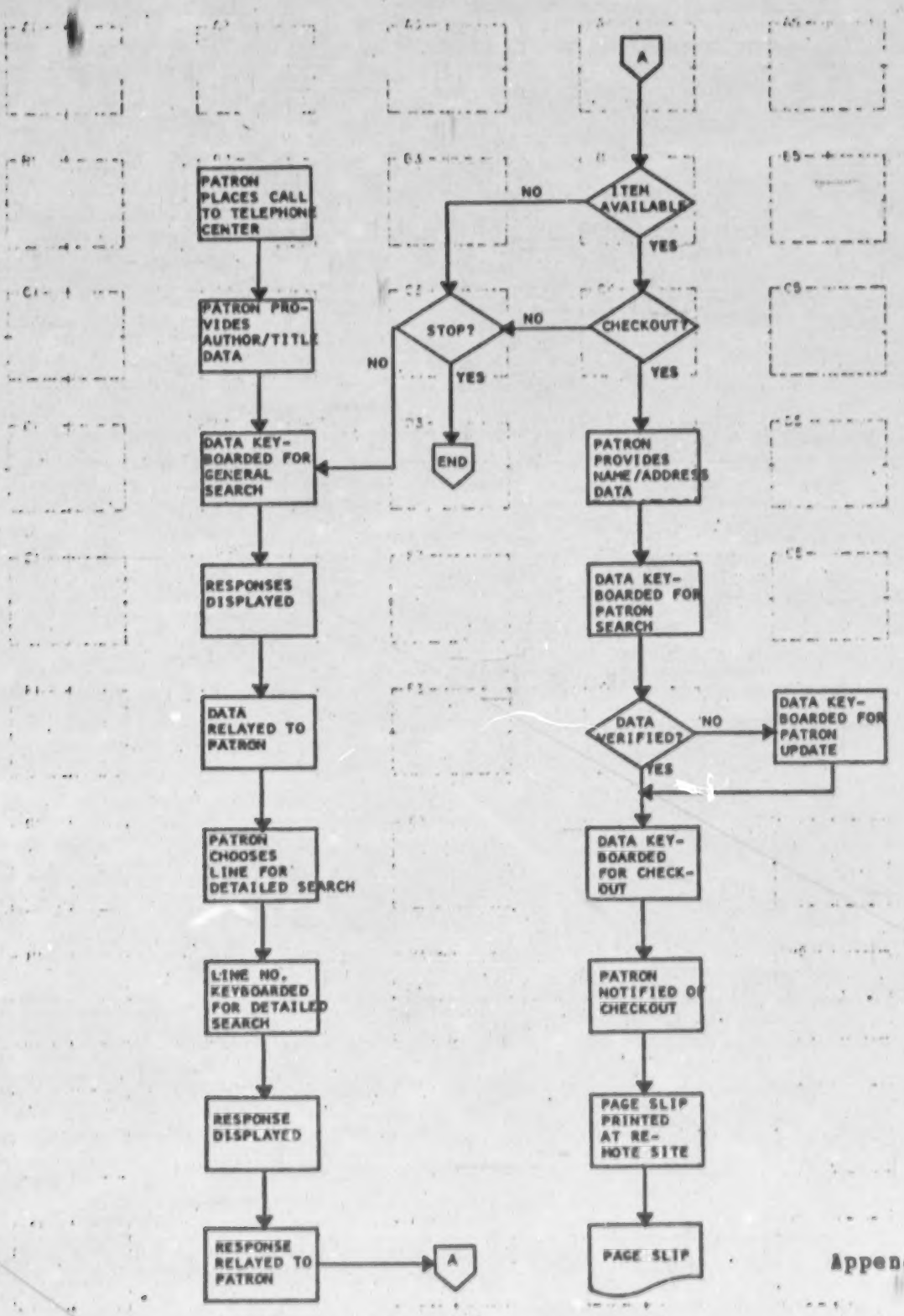


OSU SYSTEM SAMPLE TRANSACTIONS

In order to better aquaint the reader with the operational aspects of the proposed system, let us trace through a hypothetical phone call to any of the libraries or the Telephcne Center.

At the outset of the conversation the patron's identification is verified with the patron search below (figure 1):

```
SH2/123456789
JOHN DOE
1234 MAIN ST.
LAFAYETTE
IN  47901
US        VISITOR
EXP 730630
```

figure 1

The first line (SH2/123456789) was keyed in (as is indicated by the underlining) and the system responded with the patron's name, address, and status.

After verifying (and possibly correcting) the address information, the patrcn indicated he would like to check out a copy of the 1920 edition cf Joseph Conrad's Lord Jim. The following general search was then entered:

```
SH1/CONRLORD
PAGE 1          15 MATCHES      0 SKIPPED      (NOT ALL RETRIEVED)
01 CONRAD, JOSEPH               LORD JIM
02 CONRAD, JOSEPH               LORD JIM                          1946
03 CONRAD, JOSEPH               LORD JIM                          1968
04 CONRAD, JOSEPH               LORD JIM, A ROMANCE               1924
05 CONRAD, JOSEPH. 1857-1924    LORD JIM                          1968
06 CONRAD, JOSEPH               LORD JIM                          1959
07 CONRAD, JOSEPH               LORD JIM                          1923
08 CONRAD, JOSEPH               LORD JIM                          1931
09 CONRAD, JOSEPH               LORD JIM                          1914
10 CONRAD, JOSEPH               LORD JIM                          1921
```

figure 2

The search key ('CONRLORD ') was made up of the first four characters of the author's last name and the first five characters of the title.

A glance at the right hand column of figure 2 reveals that the 1920 edition does not appear on this screen so a page command is entered to view the last three entries (figure 3).

```
PG2
 PAGE 2                  13 MATCHES        0 SKIPPED      (ALL RETRIEVED IN 2)
11 CONRAD, JOSEPH                  LORD JIM                              1925
12 CONRAD, JOSEPH                  LORD JIM                              1920
13 CONRAD, JOSEPH                  LORD JIM                              1926
```

figure 3

It is readily seen that the library does hold the 1920 edition. To determine the status of all copies of the title, a detailed search is executed (figure 4).

```
SH2/LN=12/ALL
PR600504161920   CONRAD, JOSEPH   LORD JIM   BOLC    T53114   1920   0003
01      001 3WEEK UND
02      002 3WEEK UND
03      004 3WEEK WCL
```

figure 4

Finally, copy 1 is checked out to Mr. Doe (figure 5).

```
CHO/LN=1/PI=123456789/RMT
PAGE          123456789
PR600504161920
CONRAD, JOSEPH                  001   UND
LORD JIM                              238837   T31207
```

figure 5

This transaction also results in a page slip being printed at the library (in this case UND) holding copy 1.

OTHER TRANSACTIONS

Some other examples of transactions executed on the terminals are:

Charge (using call number as the book identifier):

```
CHO/CL=926.2587+5RO/C1/PI=123456789/RMT
PAGE          123456789
926.2587+5RO
ROWLAND, JOHN. 1907-            001  GENL
GEORGE STEPHENSON, CREATOR OF   238837  T31230
```

Discharge (with a save pending on the title):

```
DCG/CL=926.25ST45RO/C1
DISCHARGE        123456789
926.25ST45RO
ROWLAND,JOHN. 1907-                001  GENL
GEORGE STEPHENSON, CREATOR OF  238837  731225

PLEASE CHARGE: 987654321
```

Renewal:

```
REN/CL=926.25ST45RO/C1/PI=123456789/DUE=731230
RENEWAL          123456789
926.25ST45RO
   001  238837  731230
```

Save:

```
SVE/TN=238837/PI=987654321
DONE
```

Snag:

```
SNG/TN=238837/C1
TRANSACTION COMPLETED
```

General search (on author):

```
SH1/CONR-----/SKIP=30
 PAGE 1          305 MATCHES      30 SKIPPED      (NOT ALL RETRIEVED)
01 CONRAD, JOSEPH                CHANCE
02 CONRAD, JOSEPH                CHANCE                              1914
03 CONRAD, JOSEPH                CHANCE
04 CONRAD, JOSEPH                CHANCE                              1949
05 CONRAD, JOSEPH                CHANCE, A TALE IN TWO PARTS         1914
06 CONRAD, JOSEPH                CHANCE                              1930
07 CONRAD, JOSEPH                THE CHILDREN OF THE SEA             1897
08 CONRAD, JAMES HENRY           CHILDREN'S BUREAU IN WORLD WAR I    1966
09 CONRAD, FRED GEORGE           A CLINICO-PATHOLOGIC STUDY OF ACUTE MY 1958
10 CONRAD, MARION JAMES          A COMPARATIVE STUDY OF THE FORTY MINUT 1946
```

Note that all transactions have a common syntax: a transaction code (e.g. CHG) followed by various operands (e.g. CL 926.25ST45RO) separated by slashes. Some of these codes and their meanings are:

SH1,SH2,CHG,DCG,REN,SVE,SNG,PGn
: the transaction codes for the general and detailed searches, charge, discharge, renew, snag, and page transactions.

CL call number
PI patron identification number
LN line number (of the current screen)
TN title number
Cn copy number n
RMT code signifying a remote checkout
DUE due date (used to override the computer calculated date)
SKIP=n begin retrieval with the n+1'st record which matches the search key (general search)

COMPARISON OF TOTAL COSTS: EXISTING vs PROPOSED SYSTEMS

	Year of System Operation					
	1	2	3	4	5	6
Case 1: 5% inflation of personnel and supplies costs, 15% annual increase in circulation						
Circulation	422,325	485,901	558,786	642,604	738,995	849,844
Existing System						
Library Direct Labor	329,416.02	395,299.23	474,359.08	569,230.89	683,077.07	819,074.77
Supplies	9,796.40	11,755.68	14,106.81	16,928.17	20,313.80	24,376.56
Total for Year	339,212.42	407,054.91	488,465.89	586,159.06	703,390.87	843,451.38
Cumulative Total	339,212.42	746,267.33	1,234,733.22	1,820,892.28	2,524,283.15	3,367,734.48
Proposed System						
Hardware additional						
lease (or)	150,543.48	150,823.56	152,497.56	141,365.52	162,161.52	88,046.40
purchase	320,617.91	86,779.20	87,073.20	87,381.96	87,706.08	88,046.40
existing	18,000.00	18,000.00	18,000.00	18,000.00	18,000.00	18,000.00
Software Maint.	8,814.00	9,254.70	9,717.43	10,203.30	10,713.47	11,249.14
Developmental Costs (see "Economic Evaluation" for detail)	81,343.30					
Shelflist Conversion (Appendix O)	72,205.65					
Library Direct Labor	180,318.89	216,382.67	259,659.20	311,591.04	373,909.25	448,691.10
Total for Year						
lease (or)	511,205.32	394,460.93	439,874.19	481,159.86	564,784.24	565,986.64
purchase	681,299.75	330,416.57	374,449.83	427,176.30	490,328.80	565,986.64
Cumulative Total						
lease (or)	511,205.32	905,666.25	1,345,540.44	1,826,700.30	2,391,484.54	2,957,471.18
purchase	681,299.75	1,011,716.32	1,386,216.15	1,813,392.45	2,303,721.25	2,869,707.89
Case 2: 5% inflation of personnel and supplies costs, no annual increase in circulation						
Existing System						
Library Direct Labor	329,416.02	345,886.82	363,181.16	381,340.22	400,407.23	420,427.59
Supplies	9,796.40	10,286.22	10,800.53	11,340.56	11,907.59	12,502.97
Total for Year	339,212.42	356,173.04	373,981.69	392,680.77	412,314.81	432,930.55
Cumulative Total	339,212.42	695,385.46	1,069,367.15	1,462,047.92	1,874,362.73	2,307,853.28
Proposed System						
(no change for items listed in case 1 not listed here)						
Library Direct Labor	180,318.89	189,334.83	198,801.57	208,741.65	219,178.73	230,137.67
Total for Year						
lease (or)	511,205.32	367,413.09	379,016.56	378,310.47	410,053.72	347,433.21
purchase	681,299.75	303,368.73	313,592.20	324,326.91	335,598.28	347,433.21
Cumulative Total						
lease (or)	511,205.32	878,618.41	1,257,634.97	1,635,945.44	2,045,999.16	2,393,432.37
purchase	681,299.75	984,668.48	1,298,260.68	1,622,587.59	1,958,185.87	2,305,619.08
Costs per Circulation						
Case 1						
Existing System	.8028	.8377	.8742	.9122	.9519	.9925
Proposed System*						
lease (or)	1.2559	.8118	.7872	.7488	.7643	.6660
purchase	1.6737	.6800	.6702	.6648	.6635	.6660
Case 2						
Existing System*	.8028	.8750	.9188	.9647	1.0129	1.0636
Proposed System						
lease (or)	1.2559	.9026	.9311	.9294	1.0074	.8535
purchase	1.6737	.7453	.7704	.7968	.8245	.8535

* most probable case for this system

Circulation by Departmental Library for the 1970-1971 Academic Year

Division/Unit	Home Use	Library Use	Reserve Book Use	Total Book Uses
General Library	191,635	749,365	64,542	1,005,542
School of Agriculture				
Dairy	0	0	0	0
Life Science	34,658	136,823	28,693	200,174
Biochemistry	2,572	71,343	7,619	81,534
Forestry-Hort	4,887	10,921	9,153	24,961
Entomology	0	0	0	0
Ag Engineering	0	0	0	0
Total Agriculture	42,117	219,087	45,465	306,669
Schools of Engineering				
AAES&IE	10,241	15,357	2,796	28,394
Chem. Eng./M. Sci.	5,926	7,315	9,335	22,576
Civil Eng.	9,142	12,402	10,578	32,122
Nuclear Eng.	5,186	30,612	4,400	40,198
Electrical Eng.	17,321	11,380	5,363	34,064
Mechanical Eng.	7,435	6,387	4,602	18,424
Goss Libraries	0	109	0	109
Total Engineering	55,251	83,562	37,074	175,887
School of Home Ec.	11,951	58,531	20,035	90,517
School of HSSE				
Communications	1,825	1,740	0	3,565
CDFL	0	0	0	0
Education	0	60,844	0	60,844
Phil-Polisci	2,397	337	2,335	5,069
Psychology	14,378	28,913	25,750	69,041
Sociology	0	0	0	0
Total HSSE	18,600	91,834	28,085	138,519
School of Ind. Mgmt.	23,605	67,662	31,355	122,622
School of Pharmacy	7,949	45,034	5,256	58,239
School of Science				
Chemistry	15,204	49,232	9,335	73,771
Geosciences	2,289	5,487	1,340	9,116
Mathematics	19,836	79,979	16,664	116,479
Physics	9,011	8,851	1,838	19,692
Total Science	46,340	143,549	29,169	219,058
School of Technology	810	4,575	518	5,903
School of Vet. Sci.	13,092	37,109	3,500	53,701
Total Dept. Libs.	219,715	750,943	200,457	1,171,115
Total Libraries	411,350	1,500,308	264,999	2,176,657

source: Libraries and AVC Cost Study, August, 1971

Circulation by School
1969-70 - 1971-72

	1971-72		1970-71		1969-70	
	At Home	Total*	At Home	Total	At Home	Total
Agriculture	30,962	253,797	31,447	189,129	26,552	157,444
Veterinary Science	11,901	43,030	10,785	45,689	10,152	48,345
Home Economics	10,293	68,881	10,001	49,920	13,440	69,077
Engineering	51,016	117,958	46,933	106,356	37,497	87,423
Industrial Administration	24,591	78,423	25,284	87,376	23,400	75,539
Pharmacy	6,123	41,323	7,629	49,308	5,114	56,914
HSSE & General **	187,603	637,934	183,392	626,731	178,463	602,192
Science	52,112	243,786	45,708	214,452	34,350	189,735
Technology°	1,273	2,786	744	1,831	386	1,256
Total	375,874	1,487,918	361,923	1,370,792	329,414	1,287,925

* At home plus in library use.

** General Library has been added to HSSE

° Circulation from Aviation Technology only

source: Book Fund Allocation, IMRU, January, 1973

Appendix L

Comparison of Manual Effort: Existing vs. Proposed Systems

FTE.

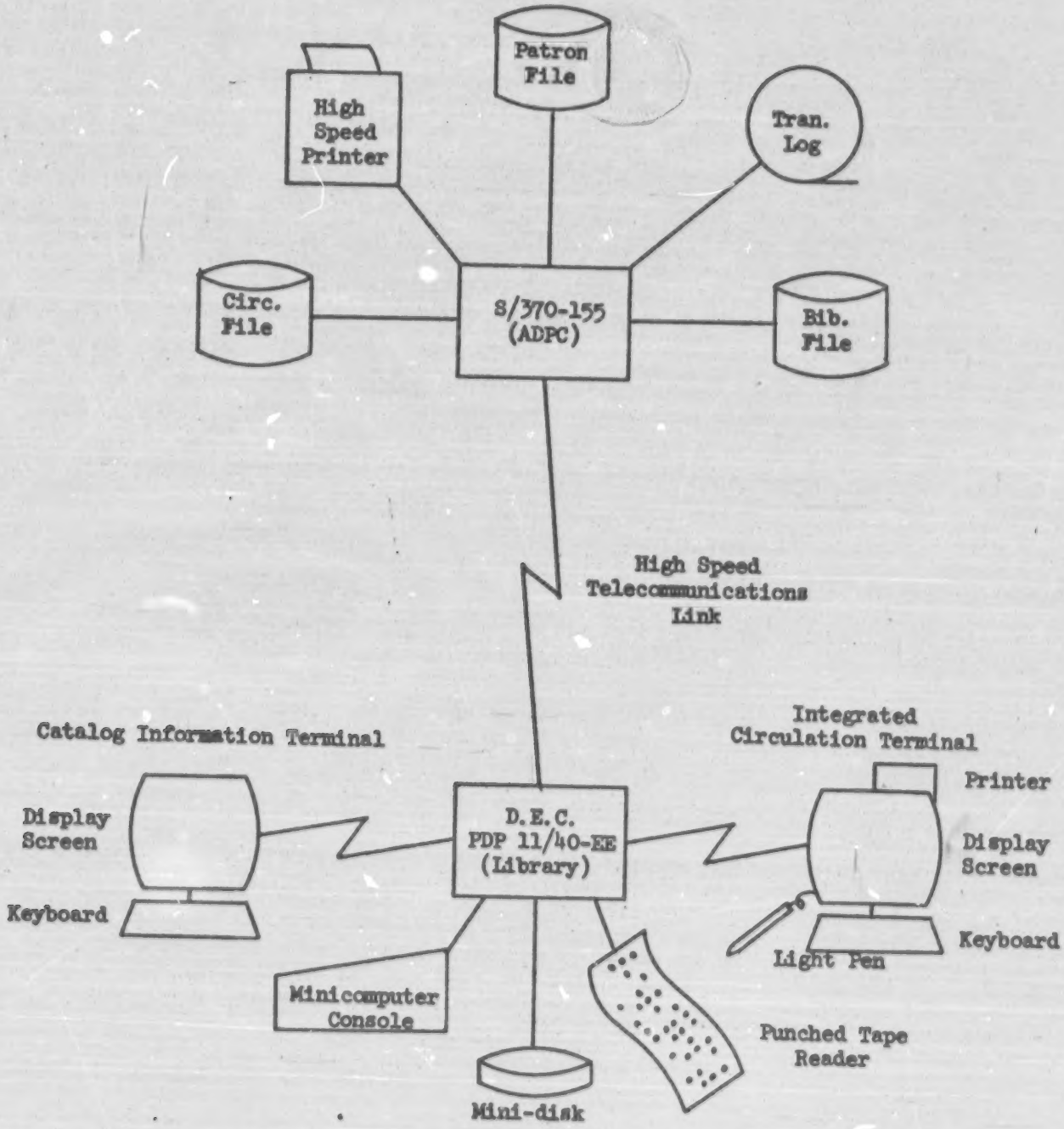
Function	Existing System				Proposed System			
	Prof	Tech	Clrk	Stud	Prof	Tech	Clrk	Stud
Checkin	.066	.833	4.480	1.240	.022	.283	1.523	.421
Checkout*								
transaction card		.066	3.000	5.900		.020	.900	1.770
book card	.083	.534	2.880	1.000	.062	.400	2.160	.750
Encumbrance prep.		.410	.660			.410	.660	
Interlibrary**	.016	.266	.646		.008	.133	.323	
Overdue Notice preparation		.400	2.540					
Recall Notice preparation	.003	.316	.486	.138	.001	.158	.243	.069
Reserve	.166	1.600	7.010	5.260	.106	1.020	4.486	3.366
Saves	.003	.416	.875	.066	.001	.137	.288	.022
Shelving	.016	.433	1.460	4.290	.016	.433	1.460	4.290
Snags	.016	.166	.611	.005	.016	.166	.611	.005
Statistics Gathering		.266	.733	.305		.026	.073	.030
Status Inquiry	.166	1.116	4.172	.898	.083	.558	2.086	.449
Supervision	.420	3.066	2.813		.228	1.666	1.645	
Total	.955	9.888	31.742	19.102	.543	5.410	16.464	11.172

* includes the in-filing of cards into manual circulation file(s)

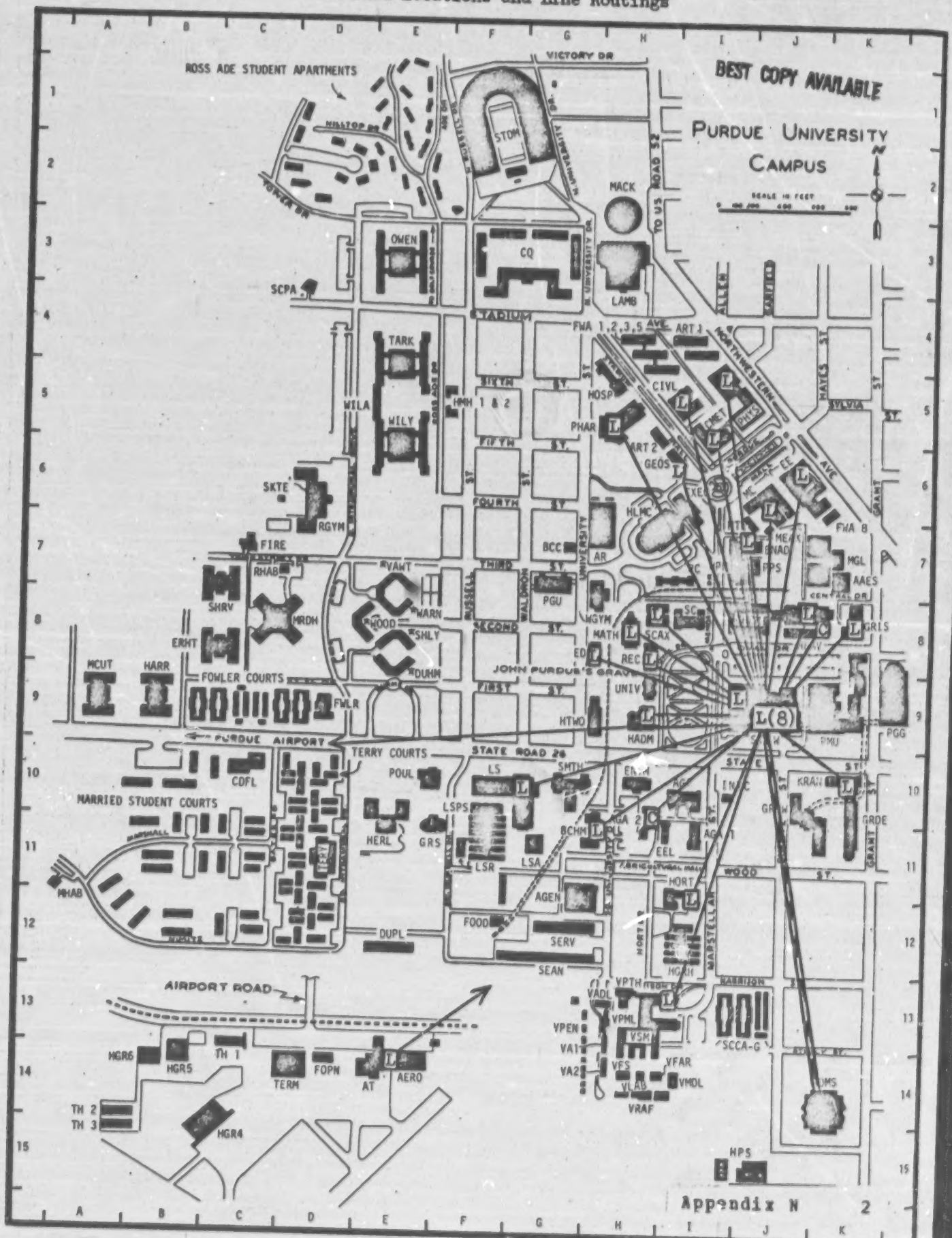
** excludes Interlibrary Loan Office

Appendix M - 1

Major Hardware Components



Terminal Locations and Line Routings



Allocation of Terminal Equipment

General Library		
circulation desk	2	
workroom	1	
Catalog Information Center	3*	
Reserve Book Room	1	
Bookstall	1	
		8
Audio-Visual Center		1
School of Agriculture		
Life Science	1	
Biochemistry	1	
Forestry-Hort	1	
Ag Engineering	1	
		4
Schools of Engineering		
AAES&IE	1	
Chem. Eng./M. Sci.	1	
Civil Engineering	1	
Nuclear Engineering	1	
Electrical Engineering	1	
Mechanical Engineering	1	
		6
School of Home Ec.		1
School of HSSE		
Communications	1	
Education	1	
Phil/PolySci	1	
Psychology	1	
		4
School of Ind. Mgmt.		1
School of Pharmacy		1
School of Science		
Chemistry	1	
Geosciences	1	
Mathematics	1	
Physics	1	
		4
School of Technology		1
School of Vet. Sci.		1

* Catalog Information terminals will not be equipped with data collection (light pen) equipment

Library Hardware Requirements

I. Minicomputer

(Digital Equipment Corp. PDP 11/40-EE with 16K words of main memory, 1.2 Meg words of disk storage, console, punched tape reader (for software maintenance), and all necessary line multiplexors and interfaces)

Purchase price -	$ 53,690.00
5 year lease/purchase* -	1,181.18/mo
Maintenance -	486.00/mo

II. Circulation Terminals - 29 required

(integrated terminal incorporating a Beehive SB-1 CRT, a Pitney Bowes light pen, a 12 column printer and the necessary interfacing electronics)

	Each	Total
Purchase price -	$4,953.25	$143,644.25
5 year lease/purchase -	108.97/mo	3,160.15/mo
Maintenance -	50.00/mo	1,450.00/mo

III. Catalog Information Terminals - 3 required

(Beehive SB-1)

	Each	Total
Purchase price -	$2,335.00	$ 6,864.54
5 year lease/purchase -	51.37/mo	145.86/mo
Maintenance -	25.00/mo	75.00/mo

IV. Other Communications Equipment

A. Telephone Lines

23 voice grade lines linking the minicomputer with terminals not in Stewart Center and one "C2" line linking the minicomputer to ADPC's machine.

$ 250.00/mo

B. Modems (data sets)

1. High speed (7200 bps) for the Library-ADPC line - 2 required

	Each	Total
Purchase price -	$6,900.00	$ 13,800.00
3 year lease/purchase* -	154.00/mo	308.00/mo
Maintenance -	69.00/mo	138.00/mo

2. Medium speed (1800 bps) for the links to the remote terminals - 48 required

	Each	Total
Purchase price -	$ 325.00	$ 15,600.00
3 year lease/purchase -	11.05/mo	530.40/mo
Maintenance -	4.95/mo	237.60/mo

3. Null modems (D.E.C. H312-A) for local terminals - 8 required

	Each	Total
Purchase price -	$ 65.00	$ 512.00
5 year lease/purchase -	1.43/mo	11.44/mo
Maintenance -	5.00/mo	40.00/mo

ADPC Hardware Requirements

I.	Main Memory (an additional 256K bytes (characters) of core storage will be required to run the on-line functions of the system)	$2,700.00/mo
II.	On-line storage (two spindles (200 Meg characters) of IBM 3330 disk storage)	$1,350.00/mo
III.	Line interface to the 3705 Communications Controller	15.00/mo
IV.	Computer operations overtime (required for weekend operation when ADPC is currently closed)	$3,000.00/yr. (est.)

*A great deal of flexibility is available in procuring the Library hardware; several rental and leasing plans are available from various sources. Two such plans are shown as examples. One requires the payment of 2.2% of the purchase price of the equipment per month for 5 years, at the end of which a payment of 10% of the original purchase price is made to secure title to the equipment. The other requires payments of 3.4% for three years and a similar final payment. The effect of purchasing vs. leasing can be seen in the following graph which shows the cash flow if all hardware is purchased in the first year vs. the cash flow if the indicated leasing arrangements are made.

In the area of serviceability and reliability, all hardware would, if procured in the indicated quantities, be maintained by local personnel and has an excellent reputation for reliability.

Breakdown of Cash Flow Required for Hardware
(Purchase Option)

Cost Factor	Year of System Operation 1 /mo	1 /yr	2 /mo	2 /yr	3 /mo	3 /yr	4 /mo	4 /yr	5 /mo	5 /yr	6 /mo	6 /yr
ADPC												
memory	2700.00		2700.00		2700.00		2700.00		2700.00		2700.00	
disk	1350.00		1350.00		1350.00		1350.00		1350.00		1350.00	
line set	15.00		15.00		15.00		15.00		15.00		15.00	
operations	466.66		490.00		514.50		540.23		567.24		595.60	
total ADPC	4531.66	54,379.92	4555.00	54,660.00	4579.50	54,954.50	4605.23	55,262.76	4632.24	55,586.88	4660.60	55,927.20
Library												
minicomputer maint.	486.00		486.00		486.00		486.00		486.00		486.00	
purch.		53,690.00										
circulation terminals maint.	1450.00		1450.00		1450.00		1450.00		1450.00		1450.00	
purch.		143,644.25										
catalog info. terminals maint.	75.00		75.00		75.00		75.00		75.00		75.00	
purch.		6,864.54										
phone lines	250.00		250.00		250.00		250.00		250.00		250.00	
modems maint.	415.60		415.60		415.60		415.60		415.60		415.60	
purch.		29,920.00										
total Library	2676.60	266,237.99	2676.60	32,119.20	2676.60	32,119.20	2676.60	32,119.20	2676.60	32,119.20	2676.60	32,119.20
Total	7208.26	320,617.91	7231.60	86,779.20	7256.10	87,073.20	7281.83	87,381.96	7308.84	87,706.08	7337.20	88,046.40

Total cash flow required for the first six years - $757,604.75

Breakdown of Cash Flow Required for Hardware
(Lease Option)

Cost Factor	Year of System Operation 1 /mo	1 /yr	2 /mo	2 /yr	3 /mo	3 /yr	4 /mo	4 /yr	5 /mo	5 /yr	6 /mo	6 /yr
ADPC												
memory	2700.00		2700.00		2700.00		2700.00		2700.00		2700.00	
disk	1350.00		1350.00		1350.00		1350.00		1350.00		1350.00	
line set	15.00		15.00		15.00		15.00		15.00		15.00	
operations	466.66		490.00		514.50		540.23		567.24		595.60	
total ADPC	4531.66	54,379.92	4555.00	54,660.00	4579.50	54,954.50	4605.23	55,262.76	4632.24	55,586.88	4660.60	55,927.20
Library												
minicomputer												
lease	1181.18		1181.18		1181.18		1181.18		1181.18			
maint.	486.00		486.00		486.00		486.00		486.00		486.00	
purch.										5,369.00		
circulation terminals												
lease	3160.15		3160.15		3160.15		3160.15		3160.15			
maint.	1450.00		1450.00		1450.00		1450.00		1450.00		1450.00	
purch.										14,364.43		
catalog info. terminals												
lease	145.86		145.86		145.86		145.86		145.86			
maint.	75.00		75.00		75.00		75.00		75.00		75.00	
purch.										686.45		
phone lines	250.00		250.00		250.00		250.00		250.00		250.00	
modems												
lease	849.84		849.84		849.84		11.44		11.44			
maint.	415.60		415.60		415.60		415.60		415.60		415.60	
purch.						1,380.00				52.00		
total Library	8013.63	96,163.56	8013.63	96,163.56	8013.63	97,543.56	7273.23	86,102.76	7273.23	86,102.76	2676.60	32,119.20
Total	12545.29	150,543.48	12568.63	150,823.56	12593.13	152,497.56	11780.46	141,365.52	11807.47	162,161.52	7337.20	88,046.40

Total cash flow required for the first six years - $845,438.04

Appendix M 7

A TENTATIVE PLAN FOR THE CONVERSION OF THE PURDUE UNIVERSITY SHELF LIST TO MACHINE READABLE FORM WITH EMPHASIS ON THE REQUIREMENTS OF THE PROPOSED CIRCULATION SYSTEM

Within this Appendix a plan for the conversion of the shelf list to machine readable form will be developed. This plan will take into account primarily the requirements of the proposed circulation system and the modifications to be made to that system in the future. Attention is given, however, to considerations of regional and national cooperation.

The reader is referred to Appendix G which lists the fields contained in the OSU bibliographic records. At the bare minimum these would require conversion. As minimal consideration of cooperative requirements, these fields should also be tagged with the appropriate MARC tags (or some other set of tags (e.g. a mnemonic one) having a one to one correspondence with the MARC tags).

Due to the usefulness of series notes and added entries, consideration must be given to converting these items also. For example, studies of MARC records indicate a relative frequency of 8.5% and an average length of 41 characters for 400 series tagged fields. This average cost of 3 3/4 characters per record seems a small price to pay for the conversion of series notes at this time.

A study of overlap between the Purdue University shelf list and the data base of the Ohio College Library Center (OCLC) revealed a 44% overlap in English language monographs. Owing to this high hit rate (considering that OCLC is basically a post 1969 file), the fact that this overlap can only increase, and the decay in usefulness over time of those materials which are least likely to appear in an OCLC like data base, conversion of any additional fields is not advisable as far as the circulation system, with future modification, is concerned.

An outline of various keyboarding technologies will be found in COS 11/73. The technique recommended here is the in-house typing of the records and vendor supplied optical character recognition (OCR) conversion of the typed records to magnetic tape. This technique is chosen for several factors including:

1. The keyboarding rate is significantly higher than with keypunch or keytape type operations.

2. The necessary typewriters could be redistributed after the conversion project. Additional personnel could be assigned to the project with minimal additional capital expense.

3. Computer resources are not required during the keyboarding operation as they would be with any on-line technique. This allows great flexibility in scheduling personnel.

From past experience it is recommended that the conversion employ IBM Selectric typewriters with OCR-B upper and lower case font. One time use (film) ribbons and a good quality paper are also necessities.

Based on the OSU experience, and accounting for inflation, their costs have been pro-rated based upon relative numbers of titles to arrive at the approximate cost for our conversion presented in the 'Economic Evaluation' of $72,205.65. The implicit assumption is that the economies of in-house typing are equivalent to the additional keystrokes required by MARC tagging. The OCR-B font recommended is shown in figure 1.

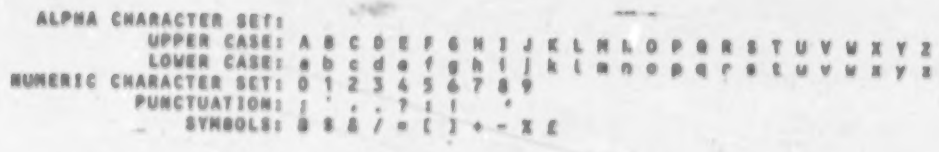

ALPHA CHARACTER SET:
UPPER CASE: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
LOWER CASE: a b c d e f g h i j k l m n o p q r s t u v w x y z
NUMERIC CHARACTER SET: 0 1 2 3 4 5 6 7 8 9
PUNCTUATION: ¡ ' , . ? : ! ¿
SYMBOLS: @ $ & / = [ ] + - X £

figure 1

END